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November 8, 2001

Ms. Sandy Olinger (AMSAM-EN)
Building 3206 Redstone Arsenal
Huntsville, Alabama 35898

Removal Action Work Plan (Revision 1)
PCB TSCA Waste
Building 3, St. Louis Army Ammunition Plant
Contract No. DACW41-00-D-0019

Dear Ms. Olinger:

This letter transmits Revision 1 of the Removal Action Work Plan for PCB TSCA Waste at Building 3, Saint Louis Army Ammunition Plant, St. Louis, Missouri. A distribution list for the Work Plan is attached.

To minimize photocopying and binding expenses, we are submitting only those portions of the Work Plan that have been modified or updated since the draft submittal. Revisions to the Work Plan are based on reviewer comments (received as of October 29, 2001) and internal peer review. The following inserts or replacement pages/text are included with this Revision 1 submittal:

- Replacement binder cover and spine
- Replacement text (all) to Work Plan
- Replacement tables (all) to Work Plan
- Replacement figures (Figures 3-1, 3-10, 3-11, and 3-12 only) to Work Plan
- Replacement cover and introductory text to the SAP (Appendix A of the Work Plan)
- Replacement text (all) to Field Sampling Plan, Part 1 of the SAP (Appendix A of the Work Plan)
- Replacement forms (select forms) from Appendix A of the FSP, Part 1 of the SAP (Appendix A of the Work Plan)
- Replacement text (all) to Quality Assurance Project Plan, Part 2 of the SAP (Appendix A of the Work Plan)
- Replacement cover and select pages (Pages 5-7 and 5-8) from the Safety, Health, and Emergency Response Plan (Appendix B of the Work Plan)

12920 Metcalf, Suite 150 • Overland Park, KS 66213 • (913) 814-9994 • FAX (913) 814-9997

- Replacement Appendix D (all) of the Work Plan
- Replacement project form from Appendix E of the Work Plan

The beginning of each replacement section is identified by a blue fly sheet. Please insert the replacement pages into the applicable sections of the 3-ring binder that was provided for the Draft Work Plan.

If you should have any questions regarding the Work Plan, please call us at (913) 814-9994.

Sincerely,

Greg Wallace

Greg Wallace, R.G.
Project Manager

Enclosures:

Cc: See attached distribution list

Organization/Company Representative	Organization/Company	Number of Copies
Ms. Sandy Olinger	U.S. Department of the Army, Aviation and Missile Command	3
Mr. Bradley Eaton	U.S. Army Corps of Engineers, Kansas City District	4
Mr. Ray Allison	U.S. Army Corps of Engineers – Ft. Leonard Wood	1
Mr. Dave Phillippi	U.S. Environmental Protection Agency	1
Mr. Tom Lorenz	U.S. Environmental Protection Agency	2
Mr. Jim Harris	Missouri Department of Natural Resources	1
Mr. Greg Wallace	Arrowhead Contracting, Inc.	3

REPLACEMENT BINDER COVER AND SPINE

REMOVAL ACTION WORK PLAN
PCB TSCA WASTE
BUILDING 3
ST. LOUIS ARMY AMMUNITION PLANT
ST. LOUIS, MISSOURI
(Revision 1)

PRE-PLACED REMEDIAL ACTION CONTRACT
CONTRACT NO. DACW41-00-D0019
TASK ORDER NO. 0002

Submitted to:

Department of the Army
U.S. Army Engineer District,
Kansas City Corps of Engineers
700 Federal Building
601 East 12th Street
Kansas City, Missouri 64106

Department of the Army
Aviation and Missile Command
Building 3206 Redstone Arsenal
Huntsville, Alabama 35898

Submitted by:

Arrowhead Contracting, Inc.
12920 Metcalf Avenue, Suite 150
Overland Park, Kansas 66213

November 8, 2001

Arrowhead Contracting, Inc.

REMOVAL ACTION WORK PLAN
PCB TSCA WASTE
BUILDING 3
ST. LOUIS ARMY AMMUNITION PLANT
ST. LOUIS, MISSOURI

PRE-PLACED REMEDIAL ACTION CONTRACT
CONTRACT NO. DACW41-00-D0019
TASK ORDER NO. 0002

NOVEMBER 8, 2001

REPLACEMENT TEXT – RA WORK PLAN

REMOVAL ACTION WORK PLAN
PCB TSCA WASTE
BUILDING 3
ST. LOUIS ARMY AMMUNITION PLANT
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November 8, 2001

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List of Acronyms

ACM	asbestos-containing material
AMCOM	Aviation and Missile Command
ARAR	applicable and relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
AVSCOM	U.S. Army Aviation Systems Command
APR	air-purifying respirator
CAR	corrective action report
CENWK	U.S. Army Corps of Engineers, Kansas City District
CERCLA	Comprehensive, Environmental, Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COR	Contracting Officer Representative
DFW	definable feature of work
DoD	Department of Defense
DOT	Department of Transportation
DQCR	Daily Quality Control Reports
DQO	data quality objective
DRO	diesel range organics
EBS	environmental baseline survey
EPA	U.S. Environmental Protection Agency
FMCSR	Federal Motor Carrier Safety Regulation
ft^2	square feet
FWV	Field Work Variance
FSP	Field Sampling Plan
GRO	gasoline range organics
HEPA	high-efficiency particulate air (filter)
in.	inch
$\mu g/cm^2$	micrograms per square centimeter
mm	millimeter
MS	matrix spike
MSD	matrix spike duplicate
NCR	noncompliance report
NON	notice of noncompliance
PACM	presumed asbestos-containing material
PCB	polychlorinated biphenyl
PPE	personal protective equipment
ppm	parts per million
PRAC	Pre-Placed Remedial Action Contract

List of Acronyms (cont.)

QA	quality assurance
QC	quality control
RAWP	Removal Action Work Plan
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SHERP	Safety, Health, and Emergency Response Plan
SLAAP	St. Louis Army Ammunition Plant
SLOP	St. Louis Ordnance Plant
SVOCs	semi-volatile organic compounds
TCLP	Toxicity Characteristic Leaching Potential
TSCA	Toxic Substances Control Act
USACE	U.S. Army Corps of Engineers

1.0 Introduction

This document constitutes a work plan to direct activities associated with removal of selected polychlorinated biphenyl (PCB) contamination in Building 3 at the former Saint Louis Army Ammunition Plant (SLAAP), Saint Louis, Missouri. This document was prepared on behalf of the U. S. Army Corps of Engineers (USACE), Kansas City District (CENWK) and the U.S. Army Aviation and Missile Command (AMCOM), Huntsville, Alabama under the Arrowhead Contracting, Incorporated (Arrowhead) Pre-Placed Remedial Action Contract (PRAC) number DACW41-00-D0019, Task Order 0002.

1.1 Project Summary

The primary project activities will consist of removal and disposal of PCB-contaminated concrete, waste, and soil located in Building 3 at SLAAP, 4800 Goodfellow Boulevard, St. Louis, Missouri. The location of SLAAP is shown on Figure 1-1. The Removal Action will selectively target materials that require disposal at a facility licensed to receive waste containing PCBs at or above 50 parts per million (ppm) - materials regulated under the Toxic Substances Control Act (TSCA). The specific materials to be removed include concrete flooring in the basement and on the first and second floors, soil and waste within the former Chip Chute area, soil in the basement, and possibly cast iron sewer (drain) piping in the basement. Other activities in the basement will include decontamination of concrete support columns and partial removal of asbestos-containing material (ACM). The removal of ACM in the basement will be performed to facilitate access to areas where contaminated concrete and soil will be removed. The removal of ACM will also be performed to avoid disturbance of ACM along planned haul routes. Ancillary activities will include site administrative support, preparation of access ways to each level of the building, staging and load-out of materials, and site safety and quality control oversight. The removal of PCB-contaminated soil outside Building 3 is not currently included in the scope of this Removal Action.

1.2 Project Roles and Responsibilities

Table 1-1 identifies organizations, roles, and responsibilities for key personnel associated with the PCB Removal Action at Building 3. A USACE-approved laboratory will be subcontracted to perform off-site chemical analysis as outlined in the Sampling and Analysis Plan (SAP) (refer to Appendix A). The USACE laboratory located in Omaha, Nebraska will analyze quality

Assurance (QA) split samples. Qualified subcontractors will be utilized to perform the following services in support of the Removal Action.

- Floor cleaning during asbestos abatement
- Worker assistance and air sampling during asbestos abatement (piping removal)
- Saw-cutting of concrete floor slabs and removal of outside wall
- Transportation and disposal of PCB-contaminated materials.

1.3 Work Plan Organization

This work plan has been organized into eight sections. The contents of each section are discussed below.

- Section 1.0 – Introduction
  - Presents a brief summary of the project scope, organizations, roles, and responsibilities of key project personnel, contents within each section of this work plan.

- Section 2.0 – Background
  - Provides a description of the site location and physical features of the building, site history, results of previous site investigation, current understanding of the nature and extent of PCB contamination, and objectives for the Removal Action.

- Section 3.0 – Removal Activities
  - Presents a description of the removal activities including site preparation, pipe and asbestos removal, concrete floor removal, soil excavation, decontamination of concrete columns, waste pile excavation, site restoration, confirmation sampling, material handling, staging, load-out, and transportation and disposal.

- Section 4.0 – Regulatory Requirements
  - This section presents a description of the regulatory requirements associated with the Removal Action.

- Section 5.0 – Site Safety and Health
  - References the Safety, Health, and Emergency Response Plan (SHERP) for site safety and health protocols to be implemented during the Removal Action.

- Section 6.0 – Contractor Quality Control
  - Presents details regarding contractor quality control to be implemented during the Removal Action.

- Section 7.0 – Project Schedule

- Presents a schedule for the field activities and reporting associated with the Removal Action.

- Section 8.0 – References
  - Presents references that are relevant to the development of this work plan.

Supporting documents associated with this Work Plan include a Sampling and Analysis Plan (SAP), a SHERP, and project specifications. These documents are included as Appendices A, B, and C, respectively. Additional supporting information, including structural engineering recommendations and project forms, are included as Appendix D and Appendix E, respectively.

2.0 Background Information

This section presents relevant background information to the planning and implementation of the Removal Action.

2.1 Site Location

St. Louis Army Ammunition Plant (SLAAP) is located at the intersection of Goodfellow Boulevard and Interstate I-70 (refer to Figure 1-1) in St. Louis, Missouri.

2.2 Site History

The St. Louis Ordnance Plant (SLOP) was constructed in 1941 to produce 0.30- and 0.50-caliber munitions in support of World War II. In 1944, approximately 21 acres in the northeast portion of SLOP was converted from small arms munitions production to 105-millimeter (mm) Howitzer shell production and was designated as SLAAP. Currently, the SLAAP property consists of eight unoccupied buildings that were used to house SLAAP main operating processes. The Removal Action for PCBs focuses solely on Building 3, also historically referred to as Building 202ABC. The processes completed in Building 3 included shell shaping, heat-treating, cleaning, painting, and packaging shells for shipment. Following World War II, SLAAP was placed on standby status, only to be reactivated to support the Korean Conflict (from November 1951 through December 1954) and the Vietnam War (from November 1966 through December 1969).

In 1984, Building 3 was renovated to include office space for personnel from the U.S. Army Aviation Systems Command (AVSCOM). The building was occupied in this capacity until 1996. In 1989, the Department of Defense (DoD) determined that SLAAP was no longer needed for munitions support and all industrial equipment was removed from the facilities. Since 1998, Building 3 has been vacant and under the control of AMCOM.

The historical use of Building 3 is summarized in the table below.

Historical Use	
Occupants/Lessees	1941 to 1944: SLOP (0.30-caliber munitions production) 1944 to 1984: SLAAP (105-millimeter (mm) Howitzer shell production – intermittent production) 1985 to 1996: SLAAP (AVSCOM office space)
Operational Periods	1941 to 1944: 0.30-caliber munitions production 1944 to 1945: 105-mm Howitzer shell production 1952 to 1954: 105-mm Howitzer shell production 1966 to 1969: 105-mm Howitzer shell production 1985 to 1996: Office space
Historical Processes	
Process Description	Processes completed in Building 3 consisted of shell shaping, heat tracing, cleaning, painting, and packaging for shipment. Metal chips and fragments produced as a result of the shell machining processes were collected on the first and second floors and disposed in the chip chute. The chip chute is an open chute along the north wall that opened to the basement in Building 3. From the basement, the metal chips were transferred to a railcar via conveyor for off-site disposal.
Process Machinery	Process machinery included lathes, drill presses, milling machines, grinders, heat-treating furnaces, wash racks, welders, shapers, shot-blasting equipment, paint spray booths, transformers, air compressors, and auxiliary equipment (dust collection devices, elevators, and conveyors).
Process Utilities	Process utilities included water, steam, compressed air, soluble oil, quench oil, paint, natural gas, telephone service, and electricity.
Hazardous Material Information	
Possible Hazardous Material Used	Cutting (soluble) oil*, quench oil (No. 6 fuel oil), hydraulic oil, solvents (toluene), asbestos, lead-based paint, and pesticides.

* contained polychlorinated biphenyls (PCBs)

2.3 Physical Features of Building 3

Building characteristics, historical uses, historical processes, and hazardous material information for Building 3 are summarized in the table below.

Building Characteristics	
Area	Basement: 37,000 square feet (ft^2) of concrete flooring First Floor: 168,000 ft^2 Second Floor: 154,780 ft^2 Penthouse: 6,813 ft^2
Style	Two stories, basement, and two penthouses
Construction Materials	Steel frame and roof beams on reinforced concrete piers and spread footings; masonry walls; and a prefabricated concrete roof. The eastside addition has the same structure, but also is covered with asbestos siding.
Construction Date	Built in 1941, retooled (including eastside addition) in 1944. Renovated to create office space in 1984 and 1985.

2.4 Previous Site Investigations

Oils containing PCBs were used in Building 3 primarily as a coolant in the milling, lathing, and smoothing processes associated with munitions production. PCBs were first discovered in Building 3 in creosote-treated wood flooring blocks during renovation activities in March 1991. The U.S. Environmental Protection Agency (EPA) Region VII was notified of the discovery and, in turn, issued a notice of noncompliance (NON) under TSCA in May 1991 (TSCA Docket Number VII-91-304).

The NON stated that the facility was not in compliance with the National Spill Clean-Up Policy for PCBs, Title 40 Code of Federal Regulation (40 CFR) Part 761.125, and requested documentation of the following four items:

- Evidence of the removal and proper disposal of all contaminated mastic and wood from both floors of building 3.
- Evidence of the removal and proper disposal of all contaminated plastic and fiberboard from the file storage area.
- Decontamination of all non-porous surfaces to less than 10 micrograms per 100 square centimeters ($\mu g/100\ cm^2$) and verification of same by submitting results of analyses from post decontamination wipe sampling to this office (EPA Region 7).
- Decontamination of all porous surfaces (concrete) to less than 10 ppm PCBs as determined by destructive sampling (core sampling).

Since the NON was issued, a number of decontamination and confirmatory sampling activities have been conducted at the site. For example, Rust Remedial Services, Inc. (Rust), formerly

Chemical Waste Management, Inc., performed decontamination and confirmatory sampling activities for the PCB contamination in Building 3 from September 1991 through August 1994. Decontamination activities included removal of the PCB-contaminated wood blocks, scarification of the concrete floor surfaces, and washing of block walls on the first and second floors of the building. Additional decontamination activities were performed in the summer of 1996 to remove PCB contamination from the first floor.

As part of the remedial approach for Building 3, a health-based risk assessment was completed to determine risk-based cleanup levels for the basement and the first and second floors of Building 3. The risk assessment concluded that residual contamination in the building did not present an unacceptable health impact and that further remediation was not necessary. The Agency for Toxic Substances and Disease Registry (ATSDR) did not endorse the health-based risk assessment. Samples collected from porous (concrete) surfaces and the non-porous (steel) surfaces in support of the risk assessment evaluation indicated residual PCB contamination was still present at concentrations that exceeded federal guidelines.

In April 1999 Tetra Tech EM, Inc. (Tetra Tech) completed a Phase I Environmental Baseline Survey (EBS) of SLAAP that included recommendation for sampling in Building 3 as part of a Phase II EBS. The results of the Phase II EBS were documented in the *Final Environmental Baseline Survey Report for the St. Louis Army Ammunition Plant, St. Louis, Missouri, December 28, 2000* (Tetra Tech, 2000). Conclusions in the EBS regarding PCB contamination in Building 3 were as follows:

- There is PCB-contaminated concrete flooring on the first floor of the building
- There is PCB-contaminated soil in the basement of the building
- There is PCB-contaminated concrete and brick walls in the basement and first-floor Chip Chute Area
- There is PCB-contaminated soil beneath the north loading dock
- There is PCB-contaminated drain and sump water

Finally, Arrowhead, under the direction of CENWK and AMCOM, completed a field investigation to determine PCB TSCA waste quantities in Building 3. The objectives of the investigation were identified as follows:

- Define the area and volume of TSCA waste (PCB contamination at concentrations of 50 ppm or greater) present in concrete, soil, and waste material at Building 3.

- Determine the composition of the chip chute waste pile and material in the basement catch basin for evaluating disposal options during the Removal Action at Building 3.
- Determine the composition of building concrete, soil, and waste for evaluating waste disposal options during the Removal Action at Building 3.
- Assess the health and safety issues associated with exposure to building materials (i.e., dust generated from concrete-removal activities) during the Removal Action at Building 3.
- Verify that oil staining is a reliable indicator for identifying TSCA waste in basement soils.

The results of this investigation were presented in a *Field Investigation Report, Determination of PCB TSCA Waste Quantities, Building 3, St. Louis Army Ammunition Plant, St. Louis, Missouri* (Arrowhead, 2001c). The findings of the field investigation by Arrowhead regarding the nature and extent of PCB contamination in Building 3, as well as other relevant findings, are summarized in the subsections following Section 2.5 (Removal Action Objectives).

2.5 Removal Action Objectives

The Removal Action will target materials in Building 3 containing PCBs at concentrations exceeding 50 ppm, the regulatory level at which materials must disposed at a facility licensed and certified under TSCA. Due to the uncertainty with regard to the analytical method for PCBs as discussed in Section 4.1.9 of the Field Investigation Report (Arrowhead, 2001c), TSCA waste materials with actual concentrations near or slightly above 50 ppm could potentially be misidentified as non-TSCA waste if the recovery of PCBs during analysis was less than 100%. To minimize the potential for false negatives and increase the certainty that Building 3 materials exceeding 50 ppm are identified, a modified action level was established using the lowest achieved matrix spike/matrix spike duplicate (MS/MSD) recovery (87%) for site samples spiked with 50 ppm of Aroclor 1248. The modified action level was calculated to be 43.5 ppm (87% x 50 ppm). The areas of PCB contamination to be removed during the Removal Action will be selected based on sample results with PCB concentrations greater than or equal to 43.5 ppm. In the context of the discussions that follow, "PCB contamination" refers to materials in which the PCB concentration exceeds the modified action level of 43.5 ppm.

The specific objectives of the Removal Action include:

- Removal of concrete, soil, and waste material in Building 3 classified as TSCA waste (with concentrations exceeding the modified action level discussed above).

- Pending sampling and analysis, the removal of PCB-contaminated cast iron sewer piping in the basement
- Transportation and disposal of TSCA waste materials at an off-site facility

2.6 Nature and Extent of PCB TSCA Waste

The areas of PCB contamination in Building 3 were identified through the collection of concrete, soil, and waste material samples as described in Field Investigation Report (Arrowhead, 2001c). The current understanding of nature and extent of PCB contamination above the modified action level is presented in the following subsections by area/media of concern.

During the field investigation, concrete samples from the first and second floors of Building 3 were collected from locations within a sampling grid. The sampling grid was established using the building columns as grid nodes, which essentially subdivided the flooring into multiple 20 foot (ft) X 20 ft sectors. Each sector was delineated by the row and column designations within the building, and the sector ID corresponded to the ID of building column in the northwest corner of the sector (refer to Figure 4-1 of the SAP). For example, "D24" represented the 20 ft x 20 ft sector where the building column in the northwest corner was located in Row D, Column 24.

Each type of sample collected during the field investigation was identified by a two- or three-character prefix as follows:

- CF1 – concrete floor sample, first floor
- CF2 – concrete floor sample, second floor
- CFB – concrete floor sample, basement
- CFP – concrete floor sample, penthouse
- CW – concrete wall sample
- CC – concrete column sample
- SS – soil sample
- WP – waste pile sample
- CB – catch basin sample

For concrete floor samples (CF1 and CF2), the prefix was followed by the sector ID. Accordingly, "CF1D24" represented the location of the concrete floor sample on the first floor in Sector D24. The aliquots from each sector were designated with the letters A, B, C, or D depending on which quadrant the aliquot sample was collected (refer to Figure 4-1 of the SAP). By convention, quadrant "A" was the northwest quadrant within the sector. The remaining quadrants, "B", "C", and "D", were designated in counter clockwise fashion from quadrant "A". For example, "CF1D24A" indicated the aliquot sample from quadrant A of Sector D24. Lastly, the sample ID for concrete floor samples from the first and second floors ended with a two-digit number representing the sample depth interval: "01" for 0 – 1 in., "12" for 1 – 2 in., and "23" for 2 – 3 in.. Consequently, "CF1D2423" represents a concrete floor sample, collected from the first floor from the Sector D24 at a depth interval between 2 and 3 inches below the original floor surface.

For all remaining samples (CFB, SS, WP, etc.), the prefix was followed by the sample location ID and then the depth interval. The location IDs started with "01" for the first sample of a given type and ended with the highest two-digit number necessary. For example, the 53 soil sample locations for the field investigation began with location SS01 and ended with location SS53. The depth interval was represented by a four-digit number – i.e., "0006" for 0 – 6 in., "3642" for 36 – 42 in., etc.

2.6.1 Concrete Flooring - Basement

PCB contamination of concrete flooring in the basement was evaluated through the collection of discrete concrete samples. The samples were collected from oil-stained areas. The PCB analytical results of all concrete floor samples collected in the basement are presented in Figure 2-1.

The PCB contamination in concrete flooring in the basement covers a total area of approximately 4,900 ft^2. As shown on Figure 2-1, a 2,800 ft^2 linear zone of PCB contamination exists between Rows 20 and Row 21. Another large area PCB contamination (approximately 1,500 ft^2) is located around Sector G11. Two smaller areas of contamination are located adjacent to the chip chute and within Sector B13. The detection of PCB concentrations above the modified action level in several samples from the 1 to 2 in. depth interval suggests that PCB contamination extends deeper than 2 inches in many areas. An estimate of the quantity of TSCA waste associated with concrete flooring in the basement is presented in Table 2-1.

2.6.2 Concrete Walls and Columns - Basement

PCB samples were collected from oil-stained columns in the basement. Samples were collected from either the vertical column or the base of the column, depending on where the most significant oil staining was observed. Concrete samples were also collected from the oil-stained portions of the three walls in the chip chute area of the basement. The PCB analytical results of all column and wall samples collected from the basement are presented in Figure 2-1. PCB concentrations were below the modified action level in all samples collected form the chip chute walls. Only one concrete column sample contained PCBs at a concentration exceeding the action level:

- Column F12 (sample ID CC21-01) – 146.6 ppm

Note that all column and wall samples were collected from 0 to 1 in. below the surface. The generally low PCB concentrations in column and wall samples suggest that PCB contamination does not significantly penetrate vertical surfaces.

Samples were not collected from all of the oil-stained columns in the basement. To increase the certainty that TSCA wastes associated with the columns are addressed during the Removal Action, the un-sampled concrete columns located within or near areas of PCB-contaminated flooring will be included in the Removal Action. These columns include:

- Column B12
- Column B18
- Column C18
- Column H14
- Column H15

Based on field measurements of oil-staining during the investigation, the total area of PCB contamination associated with concrete columns is estimated to be 230 ft^2.

2.6.3 Soil Flooring - Basement

PCB contamination of soil flooring in the basement was evaluated through the collection soil samples. The majority of samples were collected from oil-stained areas. To validate the assumption that oil-staining was indicative of PCB contamination (if present), soil samples were also collected from non-oil-stained areas. The results from non-oil-stained areas indicated that PCBs were not present at concentrations exceeding the action level, and that oil staining is a reliable indicator of TSCA waste (if present) in soils. The PCB analytical results of all soil samples collected from the basement are presented in Figure 2-1.

The PCB contamination found in basement soils covers a total area of approximately 1,510 ft^2. As shown on Figure 2-1, the six areas of PCB soil contamination in basement (Areas A through E and the floor beneath the chip chute waste pile) are located in oil-stained areas on the west side of the building, beneath former production areas on the first floor. Areas A through E are located near or adjacent to the concrete floor in the basement. PCB levels exceeding the action level within Areas A through E were detected only in the upper 6 in. of soil, suggesting that PCB contamination is likely shallow (i.e., less than 1 ft bgs). As anticipated, PCB contamination was detected in both soil borings (SS47 and SS48) below the chip chute waste pile. The relatively high concentration of PCBs in the 12 to 18 in. sample from SS28 indicates that PCB contamination below the waste pile extends deeper than 18 in. bgs. An estimate of the quantity of TSCA waste associated with soil flooring in the basement is presented in Table 2-1.

2.6.4 Concrete Flooring – First Floor

PCB contamination on the first floor was evaluated through the collection of composite concrete floor samples and discrete floor samples. The PCB analytical results for concrete samples collected from the first floor are presented in Figure 2-2.

The PCB contamination (PCBs > 43.5 ppm) on the first floor covers a total area of approximately 11,300 ft^2. PCB contamination on the first floor is most widespread in and around the following areas: a 2,800 ft^2 area around Sector D24, a 3,400 ft^2 area around Sector H14, a 1,200 ft^2 area near Sector H10, and a 1,200 ft^2 area near Sector G29. Except for the area near Sector G29, these areas are located within the former production floor where lathes and other process equipment were once operated. The PCB-contaminated area near Sector G29 corresponds to the former drum storage area. The remaining PCB contamination on the first floor is not concentrated in any one area. Although most of the PCB contamination was found in former process areas, PCBs were detected at levels exceeding the action level in several former traffic areas (including Rows A, B, and K). PCBs were not detected in the discrete samples collected outside the main sampling grid. An estimate of the quantity of TSCA waste for the first floor is presented in Table 2-1.

2.6.5 Concrete Flooring – Second Floor and Penthouses

PCB contamination on the second floor and penthouses was also evaluated through the collection of composite concrete floor samples and discrete floor samples. The PCB analytical results for all samples collected from the second floor are presented in Figure 2-3. The concentration of

PCBs did not exceed the modified action level in concrete floor samples collected in the penthouses.

The PCB contamination on the second floor covers a total area of approximately 2,200 ft^2. The most widespread PCB contamination is a 1,000 ft^2 area near Sector D13. The remaining PCB contamination on the second floor is scattered within former production areas. Four contaminated quadrants are located within the limits of the office area south of Row G. PCB levels exceeding the modified action level were not detected within former traffic areas or in the discrete samples collected outside the main sampling grid. An estimate of the quantity of TSCA waste associated with the second floor is presented in Table 2-1.

2.6.6 Chip Chute Waste Pile and Catch Basin

PCB contamination associated with the material found in the chip chute waste pile and catch basin in the basement was evaluated through the collection of waste samples. Samples were comprised of waste material from the surface to the maximum depth (bottom) of each feature. The PCB analytical results for all waste samples collected from the chip chute waste pile and catch basin are presented in Figure 2-1. PCBs were not detected at concentrations exceeding 43.5 ppm in samples collected from the catch basin. PCB concentrations in all samples collected from the chip chute waste pile exceeded the modified action level. An estimate of the quantity of TSCA waste associated with the waste pile is presented in Table 2-1.

2.7 Other Findings Relevant to the Removal Action

The following subsections present other findings of the Field Investigation that are relevant to the Removal Action.

2.7.1 Removal Action Waste Pre-Determination

The selection of an appropriate disposal facility for the Removal Action at Building 3 will be contingent upon the TSCA and Resource Conservation and Recovery Act (RCRA) profiles of the various waste materials (concrete, soil, waste) to be shipped off-site for disposal. The TSCA profiles were evaluated through the collection of PCB samples as discussed in above. Samples were also collected during the investigation to preliminarily determine if Building 3 materials would be classified as hazardous waste under RCRA. These samples were analyzed for semi-volatile organic compounds (SVOCs) and Metals per the Toxicity Characteristic Leaching Procedure (TCLP). Additional samples were collected to determine the anticipated level of petroleum hydrocarbons in the waste materials through analysis of gasoline range organics (GRO) and diesel range organics (DRO). The results of Removal Action waste pre-determination sampling are presented in Tables 2-2 and 2-3. The following observations are made with regards to the results:

- The materials to be removed from Building 3 (concrete, soil, waste pile) will not be classified as a RCRA hazardous waste, because all RCRA metals and SVOCs were below the TCLP regulatory limits.
- GROs were not detected in the soil or waste samples.
- The DRO levels presented in Table 2-3 are not high enough to preclude Building 3 materials from being disposed in a TSCA landfill.
- The detection of elevated levels of DROs in concrete and soil indicates that hydrocarbon and PCB contamination is co-mingled.

Overall, the materials removed from Building 3 will only be classified a TSCA waste due to elevated PCB concentrations. Further waste characterization may be performed or requested by the disposal facility.

2.7.2 Structural Considerations

During the field investigation, it was determined that two different flooring support designs are present in Building 3. The second floor and majority of the first floor is supported by horizontal I-beams, situated between the primary building columns, at 20 ft. on center (o.c.) each direction. Intermediate horizontal beams (in the east-west direction) are present at 6 ft. 8 in. o.c. between the primary beams. The slab thickness in these areas is approximately 8 inches, including the concrete cap. Reinforcement was determined to be 12 in. o.c. in the north-south direction and 6 in. o.c. in the east-west direction. A portion of the first floor (approximately 40,000 ft^2) between Rows 9 and 20 is not supported by horizontal I-beams. Rather, this area is supported by the primary building columns at 20 ft. o.c.and intermediate concrete columns at 10 ft. o.c. each direction. The concrete slab thickness in this area was determined to be as much as 16 in., with reinforcement at 8 in. o.c. in the east-west direction and 9 in. o.c. in the north-south direction.

Arrowhead contacted a structural engineer from Wideman & Associates of St. Louis to assist in evaluating the impacts of removing concrete flooring during the Removal Action. The primary concerns with regards to structural safety are the load capacity of the flooring and the potential for creating unsupported (cantilevered) concrete flooring during removal. The structural engineering recommendations from Wideman & Associates are documented in a letter and supporting calculations included in Appendix D. In general, the flooring was found to be capable of supporting the dead loads and the live loads (crane and cut slabs) associated with the Removal Action. The structural integrity of the flooring will be maintained through the following safety measures:

- In areas supported by horizontal I-beams, cutting along the center line of the supporting I-beams to prevent cantilevering
- In areas supported by intermediate concrete columns, limiting the width of cantilevered flooring to 2.5 ft.
- Preventing the crane from being positioned on any portion of cantilevered flooring
- Positioning the crane to utilize the support from underlying, horizontal I-beams
- Limiting the reach of the crane to prevent increased loading on the front wheels
- Use of cribbing beneath crane outriggers to spread the floor loading
- Use of stage shoring beneath portions of concrete flooring not supported by horizontal I-beams

2.7.3 Asbestos Containing Materials

A significant quantity of piping in the basement will need to be removed during the Removal Action to provide clearance for construction equipment. The majority of this piping is covered with asbestos-containing insulation. During the investigation, the field crew surveyed the basement to map out the significant pipe runs. The locations of the piping, including the number, size, types, and linear footage, are discussed in Section 3.2.1.

Much of the ACM in the basement is damaged. During the investigation, numerous pieces or fragments of "presumed" ACM (PACM) were observed on the surface of both the concrete flooring and soil flooring. Samples of PACM were collected during a follow-up visit on September 23, 2001. Four bulk samples of PACM (unknown fibrous and powdered materials) were collected from the surface of PCB-contaminated concrete and soil flooring identified for Removal Action. Additionally, wipe samples were collected from concrete aisles that will serve as haul routes during the Removal Action. Two of the wipe samples were collected from areas that appeared "clean" (where ACM was not anticipated to be present). Another wipe sample was collected from beneath a damaged ACM pipe run. The asbestos sampling results are summarized in the following table.

Media	Location (Surface)	Sample Type	Result
Debris	Sector H16 (soil)	Bulk	Positive- 75%
Debris	Sector H19 (concrete)	Bulk	Positive – 12%
Debris	Sector F17 (concrete)	Bulk	Positive – 2%
Debris	Sector H15 (soil)	Bulk	Positive – 12%
Dust	Sector D17 (concrete)	Wipe	Positive – 3 bundles
Dust	Sector H15 (concrete)	Wipe	Positive – 7 bundles
Dust	Sector F18 (concrete)	Wipe	Positive – 21 bundles

The sampling results indicate that the surface of the soil and concrete flooring in the basement is contaminated with asbestos above the regulatory level of 1%. The detection of asbestos in wipe samples from presumed non-contaminated areas suggests that loose asbestos fibers and debris are present on horizontal surfaces in the basement. Based on the presence of ACM debris on the surface of the soil, it is believed that ACM is also present below the surface of the soil from historic foot traffic over the ACM debris.

2.7.4 Cast Iron Sewer Piping

There are numerous 4-in. and 6-in. cast iron sewer lines in the basement. These lines connect to floor drains on the first floor. Most of these floor drains are located in former process areas, and it is likely that the sewer lines carried wastewater from process operations. Thus, the lines may be contaminated with PCBs and other contaminants associated with industrial wastewater discharges (such as heavy metals). The location of the cast iron sewer piping in the basement is discussed in Section 3.2.2.

3.0 Removal Action Field Activities

This section presents details of the field activities associated with the Removal Action.

3.1 Site Preparation

This section presents details regarding field activities associated with site preparation, including the following:

- Setup of a site administration area
- Layout of areas designated for PCB, asbestos, and pipe removal
- Utility clearance
- Coordination of site security
- Preparation of haul routes

3.1.1 Site Administration Areas

The Site Administration Areas will consist of an office, sample preparation area, packaging and shipping area, lavatory facilities, hand-wash station, personnel decontamination area, equipment decontamination area, and supply storage area. The location of these facilities is shown on Figure 3-1. The setup of these facilities will occur at the onset of the fieldwork.

3.1.2 Site Layout

Site layout will occur at the onset of the fieldwork and will consist of delineation of areas and locations designated for PCB, asbestos, and pipe removal, as well as locations where concrete core samples will be collected. Areas designated for PCB removal include soil and concrete flooring in the basement, concrete flooring on the first and second floors, and waste and soil in the former Chip Chute Area. In addition, PCB contamination will be removed at the locations of six concrete column (Columns B13, B18, C18, F12, H14, and H15) located in the basement. Concrete flooring designated for removal and concrete columns designated for decontamination will be marked with spray paint.

Areas and locations designated for PCB removal in the basement (including the former Chip Chute Area), on the first floor, and on the second floor, are shown on Figures 3-2, 3-3, and 3-4, respectively. The locations of asbestos--wrapped piping and cast-iron sewer piping to potentially be removed in the basement are shown on Figure 3-5. The locations of concrete columns to be decontaminated are shown on Figure 3-2.

Cut lines for the concrete flooring on the first and second floors of the building will also be marked with spray paint as detailed in Sections 3.3.2 and 3.3.3. Soil flooring designated for removal in the basement will be staked to delineate the excavation boundaries. Areas of PCB-contaminated soil in the basement will be delineated based on oil staining observed at the ground surface. Asbestos-wrapped piping and cast-iron sewer piping designated for removal from the basement will be marked with flagging or spray paint.

Concrete core sample locations on the first and second floors will be marked with spay paint during the layout activities. The purpose of these samples is discussed in Section 3.1.8. The concrete core sample locations on the first and second floors are also shown on Figures 3-2 and 3-3 of the SAP, respectively.

As necessary, areas designated for PCB removal will be surrounded by caution tape to delineate areas where access is limited to authorized personnel only. Refer to the SHERP, Section 7.0, for further details on site control.

3.1.3 Utility Clearance

Utility clearance will not be required for this project. There are no active utilities located within Building 3, and there are no planned excavations outside of the building.

3.1.4 Site Security

Arrowhead will subcontract site security services for the duration of the fieldwork. A security guard will be stationed on site during off-work hours (from approximately 7:00 pm to 7:00 am during work days and 24 hours per day during non-work days). The work will generally be conducted on a schedule consisting of 11 consecutive workdays followed by a 3-day break. During the Thanksgiving, Christmas, and New Years holiday breaks security service will be required 24 hours per day. The security service will perform hourly site patrols and will document any visitors to the site. It will be the security service's responsibility to contact St. Louis Police or Fire Departments and Arrowhead personnel in the event that a break-in or other emergency occurs on-site during non-working hours. Security personnel will have a means of contacting authorities and Arrowhead personnel without leaving the site. Arrowhead will provide the security service with a list of personnel authorized to enter the site after normal working hours and during breaks.

3.1.5 Disposal Haul Routes

Trucks that will haul contaminated materials and demolition debris from the site will enter at the main gate located at the southeast corner of the site and follow designated routes while moving about the site. Loading materials in the basement into roll-off boxes will occur near the former Chip Chute Area, located on the north side of Building 3. Loading of concrete slabs from the first and second floors onto flatbed trailers will occur at the loading docks on the north side of the building. After load-out, trucks will proceed eastward along the north side of Building 3 and exit through the main entrance. Haul routes for trucks carrying equipment and materials are shown on Figure 3-6. Trucks will maintain a one-way travel route while on-site. After exiting the site, trucks will follow Stratford Avenue west to Goodfellow Boulevard, and then north along - Goodfellow Boulevard to Interstate 70. Additional information regarding material handling, including on-site load-out and transportation and disposal is presented in Section 3.8.

3.1.6 Staging Area at the Former Chip Chute

A staging area will be created at the former Chip Chute for stockpiling of materials from the basement of Building 3. To facilitate removal of materials from the staging (stockpiling) area, a portion of the exterior block-and-brick wall will need to be demolished. In addition, it will be necessary to remove concrete flooring and support I-beams on the first floor (located immediately above the Chip Chute waste pile) and the metal rack formerly used for the Chip Chute hoist system (refer to Figures 3-7 and 3-8). Following demolition of the exterior wall, the concrete flooring will be removed and placed into a roll-off container designated for disposal of TSCA waste. The concrete flooring is approximately 20 feet by 20 feet in area and approximately 8 inches thick. There are two metal I-beams underlying the concrete flooring that will also be removed (refer to Figure 3-7). The wall and floor materials will be removed in general accordance with the methods described below.

Approximately 20 ft. x 35 ft. of wall extending from the foundation to the roof will be removed. A portion of the concrete foundation wall may also be removed to accommodate removal of materials from the basement. The wall materials will be saw cut (using a track-mounted saw) to the existing steel I-beam supporting the roof. The metal bracing on the inside face of the wall will then be cut at points where the bracing intersects the saw cuts. A ram hoe stationed outside the building may be used to knock out the wall material between the two cuts. Alternatively, holes may be drilled into selected locations in the wall, chain (lifting-grade) attached to the wall via the interior bracing, and then the wall pulled outward away from the building with a backhoe or other heavy equipment. The debris will then be placed into a roll-off box for non-hazardous demolition material.

Once the wall opening is completed, the concrete flooring above the Chip Chute Area will be removed. The flooring will be cut into multiple slabs with a walk-behind concrete saw. Two holes will be cored through each slab to accommodate a bolt/hoist ring assembly (refer to Figure 3-10). The slabs will be rigged via lifting chain to the bucket of an industrial crane. The slabs will then be lifted from the flooring and transported to the loading dock. The slabs will be temporarily staged at the loading dock for off-site transport and disposal (refer to Section 3.1.8). The floor support beams will then be cut out in ten-foot sections with the use of a cutting torch and decontaminated with a steam cleaner. The beams will be placed into the roll-off box designated for non-hazardous demolition material.

The metal framing associated with the hoist system for the former Chip Chute operation will then be removed to permit access to other parts of the basement. The metal framing is constructed of angle iron approximately 14 ft. long by 6 ft. tall by 6 ft. wide. It is bolted to the basement floor. The rack will be cut into pieces with the use of a rotary saw or cutting torch and then removed from the basement and placed into a roll-off container designated for TSCA waste. A concrete footing (6 in. x 6 in.) surrounding the metal rack will also be removed with a jack hammer. The concrete debris will be removed from the basement and placed into a roll-off container designated for TSCA waste.

The final step in this activity will involve leveling the mounds of waste material in the former Chip Chute Area to facilitate staging of materials in the area. A backhoe positioned outside the Chip Chute will be used to spread and level the waste. Once the waste is leveled, plastic sheeting will be placed over the waste so that the asbestos bags, and doubled wrapped ACM piping can be staged in the area without coming in contact with the waste.

Following removal of the ACM from the basement, the plastic sheeting will be removed and disposed of as TSCA waste. A portion of the waste in the former Chip Chute Area will then be excavated out to provide space for staging other materials removed from the basement. The waste will be excavated with the use of a backhoe or excavator stationed outside the Chip Chute and placed directly into a roll-off container designated for TSCA waste.

3.1.7 Staging Areas at the Loading Docks and former Quench Tanks

A staging area will be established on the second floor adjacent to the opening of the former quench tanks (refer to Figure 3-1). The area will be used to stage contaminated concrete slabs removed from the second floor. Preparation of this staging area will require placement of cribbing to temporarily stockpile the concrete slabs. Material staging in this area is discussed in Section 3.8.1.

A staging area will also be established at the former loading docks located at the northeast corner of Building 3 as shown on Figure 3-1. These areas will be used to stockpile PCB-contaminated concrete slabs removed from the first and second floors of the building. Preparation of this staging area will require placement of cribbing (wood boards) to temporarily stockpile the concrete slabs. Material staging in this area is discussed in Section 3.8.1.

3.1.8 Pre-Removal Concrete Core Sampling

Concrete core samples will be collected at selected locations on the first and second floors of Building 3 to address data gaps regarding the extent of PCB contamination. These data gaps resulted because of differences between preliminary and final chemical analysis results from the Field Investigation (Arrowhead, 2001c). Final sample results were received following completion of the fieldwork and were often different from the preliminary results used to guide the selection of sample locations in the field. Due to the differences in preliminary and final results, PCB data gaps remained for the following sectors:

- CF1K11
- CF1K13
- CF1K17

In addition, the following quadrants represent data gaps due to inconsistent PCB results from adjacent quadrants:

- CF1A20A
- CF1B25B
- CF1C14B
- CF1D13D
- CF1E18C
- CF1F19A

- CF1K19A
- CF2D19D
- CF2E11D
- CF2F14B
- CF2G11C
- CF2G22B

The samples will be collected in accordance with a SAP included as Appendix A. The concrete core samples will be collected at the onset of the fieldwork so that any additional concrete floor sectors/quadrants designated as TSCA waste are identified prior to removal activities.

3.2 Asbestos and Pipe Removal

This section presents details regarding removal of asbestos-wrapped piping and cast-iron sewer piping in the basement of Building 3. This activity is being performed for the following reasons:

- The presence of overhead piping will preclude access of heavy equipment to areas targeted for concrete and soil removal. This equipment will be used for the removal of PCB-contaminated concrete flooring and soil in the basement.
- Piping is present beneath some of the areas where concrete will be removed from the first floor. Hangers that are attached to the concrete flooring support this piping and will need to be detached prior to removal of the flooring.
- Piping will be removed from the chip chute area to facilitate use of this area for staging of contaminated materials (soil and concrete) from the basement.
- Many sections of piping have been damaged and ACM has fallen onto the concrete and soil floor of the basement. The small pieces of ACM and other particles present on the basement floor could be disturbed by foot traffic and heavy equipment during the removal of PCB-contaminated concrete and soil.
- Cast iron sewer piping was used during plant operations to convey waste fluids that potentially contained PCBs. The piping may contain sediments that are classified as TSCA waste.

3.2.1 Asbestos Removal

This activity will include removal of the fallen pieces of asbestos pipe wrapping and the dust located on the basement floor as well as portions of the asbestos wrapped piping hung from the basement ceiling. The table below lists the estimated quantities of asbestos-wrapped piping that will be removed as part of this effort.

Outer Diameter of Asbestos Wrap (inches)	Estimated linear feet of Pipe Scheduled for Removal
12	555
10	110
8	260
6	345
5	755
4	450
3	69
Total	**2,544**

The location of piping to be removed is shown on Figure 3-5.

To prevent loose ACM debris on the flooring from becoming airborne during subsequent field activities in the basement, select portions of the surface of the concrete and soil flooring will be cleaned, including the concrete pad (37,200 ft^2) and approximately 3,000 ft^2 of soil flooring. These areas correspond to areas where construction equipment and personnel will travel and/or areas that will be removed as part of the PCB Removal Action. The flooring will be cleaned prior to commencing any other work in the basement, including piping removal. Cleaning shall include the vacuuming of ACM debris and the manual pickup of pieces of ACM that are too large for vacuuming. Vacuuming will be performed using an external vacuum ("Super-Sucker") [VECLOADER 522™ high-efficiency particulate air (HEPA) Vacuum Loader]. The vacuum will be fitted with a HEPA filter to remove particles greater than 0.3 microns in size. A manually operated valve will control flow of asbestos into a collection bag. To prevent exhaust buildup inside the basement from the diesel motor, the vacuum will be positioned outside the building. Vacuum hose will be used to access the selected areas of the basement.

The full surface area (37,000 ft^2) of the concrete pad will be vacuumed and cleaned. In the soil areas, the surface of the soil will be vacuumed to a minimum depth of 0.5 inches below ground surface. However, if visible ACM debris (such as pieces of ACM insulation) is present after removing the upper 0.5 inches of soil, additional vacuuming in select areas may be performed to remove the visible debris. ACM from manual pickup and concrete floor cleaning will be collected in asbestos disposal bags. ACM mixed with soil from floor cleaning operations will be collected in asbestos disposal bags inside a 55-gallon drum. Waste materials will be doubledbagged, vacuum-sealed, and labeled for disposal. The current estimate for waste volume is 8 cubic yards from the concrete cleaning and 5 cubic yards from the soil cleaning.

Following floor cleaning, two layers of 6-mil polyethylene sheeting will be placed over the concrete pad and beneath areas where piping is to be removed. Damaged insulation will be contained/repaired (with duct tape or spray glue) prior to commencing pipe removal. Select portions of piping (refer to Figure 3-5) will be removed by wrap-and-cut methods combined with glove-bagging as follows:

- Various metal hangers supporting the pipe from the ceiling will be removed to permit wrapping of the pipe with polyethylene sheeting. As necessary, additional support (i.e. bracing) will be provided to ensure the pipe run remains safely suspended.
- Once hangers are removed, the pipe run will be double-wrapped with 6-mil polyethylene sheeting. Seams in the sheeting and the ends of the pipe run will be sealed with duct tape.
- A glove bag will be assembled at each location of the pipe run (containing ACM) where a cut is to be made.
- Using a glove bag under negative pressure (using a low-flow HEPA vacuum), the double layer of polyethylene sheeting will be cut and rolled back to expose a 1 – 2 foot section of insulation.
- The section of insulation will be removed with box cutters and other tools as appropriate.
- The exposed pipe will be sprayed with encapsulant solution.
- The ends of the poly sheeting will then be sealed (taped) to the exposed pipe.
- The glove bag will then be removed in a manner that prevents breaching the containment.
- The glove bag, including the ACM waste, will be sealed and placed into an asbestos disposal bag.
- Once exposed cutting locations are present on both ends of a 10 – 15 foot section of piping, the double-wrapped pipe will be cut and carefully lowered to the floor.
- The pipe section will then be labeled hand-carried to a staging area in the basement.
- The piping and disposal bags will then be loaded into roll-off containers for disposal.

Alternatively, in areas where the piping interferes with the removal of concrete flooring from the first floor, longer sections of insulation may be removed from select piping. The approach will involve the use of glove bags to remove the insulation as described above. However, after the bare piping is cut, it will be lowered to the basement floor and left-in place. The glove bags will be sealed and placed into asbestos bags for disposal.

3.2.2 Cast Iron Pipe Removal

This activity will involve removal of cast-iron sewer pipe suspended from the ceiling in the basement. The table below lists the estimated quantities of cast-iron sewer pipe that potentially will be removed as part of this effort.

Type of Pipe	Outer Diameter of Pipe (inches)	Estimated linear feet of Pipe Scheduled for Removal
Cast iron sewer pipe	6	350
Cast iron sewer pipe	4	2,360
Total		**2,710**

The location of the cast iron sewer piping in the basement is shown on Figure 3-5.

Only cast-iron sewer piping that contains residual sediments with PCBs at concentrations exceeding the modified action level (43.5 ppm) will be removed from the basement. Sections of this piping may also be removed if they interfere with the removal of concrete flooring from the first floor. To identify pipe runs that potentially contain PCB contamination, one sediment sample will be collected from each of the twenty cast-iron pipe runs. The sediment sample will be colleted near the end of the pipe run. A small section of the piping will be removed in order to permit access to a sampling point. If sediment is not present at the end of the pipe run, an attempt to collect a second sample will be made at another location within the pipe run. If sediment is not present at either location, the piping will not be considered a TSCA waste. Sample collection procedures are discussed in the SAP included as Appendix A. If the sediment sample from a given pipe run contains PCBs above the modified action level, the entire pipe run will be removed and disposed as a TSCA waste.

The piping will be disassembled at pipe joints or cut into manageable (10 - 15 ft.) sections. The pipe hangers will be cut with a chop saw or industrial shears. The pipe sections will be taken to the staging area in the basement and then loaded into roll-off containers designated for TSCA waste (if contaminated) or non-hazardous waste (if non-contaminated). Cast-iron sewer piping that is not contaminated will only be removed if it interferes with Removal Action activities. Otherwise, the non-contaminated cast-iron piping will be left in place.

3.3 *Removal of Concrete Flooring*

This section presents details of field activities associated with removal of PCB-contaminated concrete flooring in the basement and on the first and second floors of Building 3. Concrete flooring removal activities will be conducted in accordance with Specification 13284N contained in Appendix C.

3.3.1 *Concrete Removal - Basement*

PCB-contaminated concrete flooring in the basement will initially be removed in 6 areas totaling 5,000 square feet (ft^2) (refer to Figure 3-2 for the location of the areas). The estimated volume of concrete to be removed is 93 yards (230 tons), based on a floor thickness of 6 inches. The majority of concrete to be removed is located between Rows 20 and 21 and near column G11. It should be noted that the concrete floor between these Rows 20 and 21 is approximately 3 feet lower than the basement flooring to the east and west. Consequently, a temporary ramp(s) will be required to access this area.

The initial step of removal will involve breaking the concrete into one-foot pieces or smaller with the use hydraulic hammer mounted to a mini-excavator or with the use of a hand-operated jackhammer. Rebar will be cut, as needed, with the use of a saw or industrial shears. The broken pieces of concrete and rebar will then be transported via a mini loader (Bobcat or equivalent) to the staging area at the former Chip Chute. Handling requirements for this material in the staging area and during subsequent steps are discussed in Section 3.8.

3.3.2 *Concrete and Soil Confirmation Sampling*

Confirmation samples of concrete will be collected to determine whether additional concrete removal is warranted. The samples will be collected every 20 feet along the perimeter and one-foot outside the edge of selected areas where concrete removal is planned (refer to Figure 3-1 of the SAP for the location of the confirmation samples). Samples will be collected from the 0-1 inch depth interval at each location. Sampling procedures are discussed in the SAP included as Appendix A. If the confirmation sample results exceed the modified action level, the associated concrete will be removed and disposed of as TSCA waste.

Confirmation samples will also be collected from the soil underlying the concrete that will be removed. One sample will be collected at the center of the contaminated area in each sector (20 ft X 20 ft area defined by the building columns) where concrete will be removed. The sample will be collected from the upper 6 inches of soil underlying the concrete or the gravel base, if present. If the PCB level exceeds the action level, the soil, including the gravel base (if present) underlying the concrete will be excavated from the entire sector. Soil will be excavated to a depth of one foot below the soil surface. Confirmation samples will be collected from two locations at the base of the excavation and from each of the four sidewalls of the excavation. If PCB levels in these samples are less than the modified action level, no further excavation will be conducted. If the PCB levels exceed the modified action, the excavation will be expanded accordingly. The process of excavation and confirmation sampling will be repeated as needed until the confirmation sample PCB concentrations indicate that all TSCA waste has successfully be removed. If the soil excavation expands beneath the concrete, then the concrete above the contaminated soil will also be removed.

Laboratory analysis will be performed within 7 days of sample collection. Sampling and analytical protocols are presented in the SAP included as Appendix A.

3.3.3 Concrete Removal – First Floor

A total of 11,300 ft^2 of PCB-contaminated concrete flooring (excluding additional flooring that may be identified for removal based on the results of pre-removal concrete sampling, Section 3.1.8) on the first floor will be removed from Building 3 (refer to Figure 3-3 for the location of the areas). The estimated volume of concrete to be removed is as follows:

- Approximately 255 yards (640 tons) will be removed from areas of the first floor (totaling 10,300 ft^2) supported by horizontal I-beams, where, on average, the floor thickness was found to be eight (8) inches. An additional 45 tons of concrete (overage) will be removed from these areas as saw cut lines will extend beyond the limits of contamination to the nearest support beams.
- Approximately 50 yards (125 tons) will be removed from areas of the first floor (totaling 1,000 ft^2) supported by vertical concrete columns, where the floor thickness is assumed to be sixteen (16) inches. An additional 70 tons of concrete (overage) from will be removed from this area as saw cut lines will extend beyond the limits of contamination to within 2.5 ft. of the inside face of the nearest row of intermediate support columns.

The removal of concrete beyond the limits of contamination is a structural safety practices designed to prevent the creation of unsupported (cantilevered) flooring (refer to Appendix D).

Concrete flooring will be removed as individual slabs. Table 3-1 presents the quantities associated with concrete floor removal on the first floor, including the number of slabs (per sector), slab weights, and linear footage of saw cutting. The limits of each slab will be marked on the floor as discussed in Section 3.1.1. The removal of the PCB-contaminated flooring on the first floor will be conducted as detailed below:

- Cut all hangers that support piping beneath the concrete flooring to be removed. [Note: The asbestos-wrapped piping will have already been removed as part of the asbestos removal activities described in Section 3.2.1.] The pipe runs will be cut and transported to an area of the basement that will not interfere with the removal activities.
- Core two holes through the concrete flooring and install hoist ring assembly as shown in Figure 3-10. To provide underlying support for the flooring in areas where horizontal I-beams are not present, stage shoring will be erected beneath each slab to be removed (refer to sketch contained in Appendix D). The hoist rings will be installed prior to construction of the shoring.
- Cut concrete around the perimeter of the slab and around building columns with a pro-grade diamond blade mounted to a hydraulically operated walk-behind concrete saw. To prevent the accumulation of exhaust gases inside the building, the saw shall be powered by a diesel engine stationed outside the building or a scrubber will be used to minimize carbon monoxide emissions. Clean water will be used to cool the blade during cutting. The slurry (cooling fluids mixed with concrete dust) generated during concrete cutting will be collected with a Shop-Vac and containerized in 55-gallon drums. Plastic sheeting will be placed on the basement floor to collect any fluid that may fall through the flooring to the basement. The plastic sheeting will not be used in areas where PCB-contaminated concrete and soil flooring will be removed in the basement. [Note: A sample of the cooling fluids will be collected and analyzed for PCBs at the onset of the cutting operation on the second floor to determine if further containerization of the fluids is warranted. The containerization of the slurry will not be required if the PCB concentration in the sample of the slurry is below the action level.] Only one operator and the concrete saw (maximum of 600 pounds) will be permitted on cantilevered sections of concrete. The concrete flooring in the areas supported by horizontal I-beams will be cut along the centerline of the I-beams as detailed in Figure 3-11. The concrete flooring in the areas supported by vertical columns in the basement will be cut as detailed in Figure 3-12.
- Rig lifting chain(s) from the hoist rings to the hook of an industrial crane following the initial cut along the side of the slab adjacent to the location where the crane is positioned. Apply tension to the hoist cable and rigging such that the slab is partially supported by the crane.
- After saw cuts are made on all sides of the slab, hoist the slab with the crane, and place it onto cribbing staged adjacent to the crane. [Note: Slabs shall be hoisted vertically to ensure that the load does not swing from an angled lift.] Slabs shall be lifted only as high

as necessary to clear obstructions while moving the slab to the cribbing positioned adjacent to the crane.

- Transport the concrete slab to the loading dock using a telescopic handler (forklift). Staging and load-out procedures for concrete floor slabs are discussed in Section 3.8.
- Once all slabs are removed from the first floor, the remaining portion of the flooring on the top of the vertical support columns will be removed. To remove the remaining flooring, a track-mounted concrete saw will be used. Saw cuts will be made on opposite sides of the column. Wedges will be inserted into the first cut on three sides of the column to prevent the saw blade from binding during the second cut. The cut section of flooring will then be pushed from the top of the column with the bucket of a mini loader. The concrete will be transported to the staging area and pulverized using a hydraulic hammer attached to the mini loader.

As discussed in the SHERP, temporary barriers will be erected to prevent workers and machinery from approaching the open flooring. Once access to an area is no longer required, fencing will be erected as discussed in Section 3.7.

3.3.4 Concrete Removal – Second Floor

A total of 2,200 ft^2 of PCB-contaminated concrete flooring on the second floor (excluding additional flooring that may be identified for removal based on the results of pre-removal concrete sampling, Section 3.1.8) will be removed (refer to Figure 3-4 for the location of the areas). The estimated volume of concrete to be removed is approximately 55 yards (140 tons), based on a floor thickness of eight (8) inches. An additional 20 tons of concrete (overage) will be removed from these areas as saw cut lines will extend beyond the limits of contamination to the nearest support beams.

Table 3-1 presents the quantities associated with concrete floor removal on the second floor, including the number of slabs (per sector), slab weights, and linear footage of saw cutting. The PCB-contaminated flooring on the second floor will be removed as follows:

- Core two holes through the concrete flooring and install hoist ring assembly as shown in Figure 3-10.
- Cut concrete around the perimeter of the slab and around building columns with a pro-grade diamond blade mounted to a hydraulically-operated walk-behind concrete saw. To prevent the accumulation of exhaust gases inside the building, the saw shall be powered by a diesel engine stationed outside the building or a scrubber will be used to minimize carbon monoxide emissions. Clean water will be used to cool the blade during cutting. The slurry (cooling fluids mixed with concrete dust) generated during concrete cutting

will be collected with a Shop-Vac and containerized in 55-gallon drums. [Note: A sample of the cooling fluids will be collected and analyzed for PCBs at the onset of the cutting operation to determine if further containerization of the fluids is warranted. The containerization of the slurry will not be required if the PCB concentration in the sample of the slurry is below the action level.] The concrete flooring in will be cut as detailed in Figure 3-11.

- Rig a sling from the hoist rings to the hook of a gantry crane. Apply tension to the hoist cable and rigging such that the slab is partially supported by the crane.
- After saw cuts are made on all sides of the slab, hoist the slab with the crane, and place it onto a pallet jack staged adjacent to the crane. [Note: Slabs shall be hoisted vertically to ensure that the load does not swing from an angled lift.] Slabs shall be lifted only as high as necessary to clear obstructions while moving the slab to cribbing positioned adjacent to the crane.
- Using the pallet jack, transport the concrete slab to the staging area located at the former quench tank area. Staging at the former quench tanks and subsequent staging at the loading docks is discussed in Section 3.8.

As discussed in the SHERP, temporary barriers will be erected to prevent workers and machinery from approaching the open flooring. Once access to an area is no longer required, fencing will be erected as discussed in Section 3.7.

3.4 Soil Removal - Basement

This section presents details of field activities associated with removal of PCB-contaminated soil in the basement of Building 3. Soil removal activities will be conducted in accordance with Specification 13284N contained in Appendix C.

3.4.1 Soil Excavation

PCB-contaminated soil in the basement will be removed in five areas (Areas A, B, C, D, and E) totaling approximately 1,110 ft^2 (refer to Figure 3-2 for the location of the areas). The estimated volume of soil to be excavated is 41 yards (67 tons), based on an excavation thickness of 12 inches.

Contaminated soil will be excavated with the use of a mini-loader. Smaller areas or areas difficult to access with the mini-loader may be excavated with the use of a shovel. The excavation methods may be modified in the field if changes are required to improve efficiency.

The excavated soil will be transported to the staging area located at the former Chip Chute. Handling requirements for this material in the staging area and during subsequent steps are discussed in Section 3.8. The excavations will be left open and therefore backfill will not be required.

3.4.2 Soil Confirmation Sampling

Once soil has been excavated, confirmation samples will be collected from the excavation base and sidewalls and submitted to an off-site laboratory for PCB analysis. Confirmation samples will be collected at three locations at the base Area A and two locations at the base of Areas B, C, D, and E. The confirmation samples will be distributed evenly over the base of each area. Confirmation samples to be collected from the sidewalls of Area A will be distributed every 20 feet along the excavation perimeter. Confirmation samples to be collected from sidewalls in Areas B, C, D, and E will be collected at four locations distributed evenly along the perimeter of the excavation. Based on the approach outlined above, it is estimated that a total of 35 confirmation samples will be collected from these areas.

Laboratory analysis will be performed within 7 days of sample collection. If PCB levels in the confirmation samples are less than the modified action level, no further excavation will be conducted. If the PCB levels exceed the modified action, the excavation will be expanded accordingly. The process of excavation and confirmation sampling will be repeated as needed until the PCB concentration of the confirmation samples indicate that soil has been removed within the excavation to a concentration less than the modified action level. Sampling and analytical protocols are presented in the SAP included as Appendix A.

3.5 Concrete Column Decontamination

This section presents procedures for decontaminating PCB-contaminated concrete columns.

3.5.1 Decontamination Process

The columns to be decontaminated include B13, B18, C18, F12, H14 and H15. The total oil-stained surface area associated with these columns of 225 ft^2. The columns will be decontaminated using TECHXTRACT®, a three-stage chemical washing process developed by Active Environmental Technologies, Inc. The three stages include:

- Surface preparation
- Contaminant extraction
- Rinsing

In the surface preparation step, TECHXTRACT® 200 and 300 are used to clean and prepare the surface (i.e. open the pore spaces) for extraction; followed by the application of TECHXTRACT® 100 to solubilize and extract the PCBs from the concrete substrate. Using a solution of water with 10% TECHXTRACT® 300, the chemicals are rinsed from the surface after application.

Chemical application (dwell) times will be determined by the manufacturer taking into consideration the PCB concentrations and depths of contamination. Typical applications times are 15 minutes for the surface preparation solutions and 45 minutes to 1 hour for the extraction solution. However, the extraction solution may be applied and left overnight. The application sequence may also be adjusted based on field conditions and recommendation by the manufacturer. For example, several passes of the surface preparation solutions may precede the extraction step. The following describes the general procedure for the TECHXTRACT® process.

- In preparation for chemical washing, polyethylene sheeting and absorbents will be placed around the base of the column.
- Using a pump sprayer, the chemical solutions for surface preparation will be applied as a mist to the surface of the concrete.
- The chemical solutions will be scrubbed into the surface using abrasive pads, stiff bristle brushes, and/or sponges.
- Following the dwell time recommended by the manufacturer, the rinsing solution will be applied, and the solutions will be removed from the surface using a wet vacuum (i.e. Shop Vac©).
- Using a pump sprayer, the extraction solution will be applied as a mist to the surface of the concrete.
- The solution will be scrubbed into the surface using abrasive pads, stiff bristle brushes, and/or sponges.
- Following the dwell time recommended by the manufacturer, the rinsing solution will be applied, and the solutions will be removed from the surface using a wet vacuum.
- The sequence of applying, rinsing, and removing each of the formulations constitutes one cycle. This cycle will be repeated as necessary to reduce the contaminant concentrations to below 50 ppm.

Liquid waste materials that collect within the wet vacuum will be transferred to a steel, 55-gallon drum and handled as discussed in Section 3.8. Based on TECHXTRACT® product literature, total liquid waste (chemical solutions, rinsate, and contaminants) is estimated to be 0.02 to 0.10 gallons/ft^2. The drum will be labeled and retained for disposal as a PCB waste. The plastic sheeting and absorbents will also be placed into a steel, 55-gallon drum and retained for disposal as a PCB waste.

3.5.2 Concrete Column Confirmation Sampling

Once decontamination has been completed, confirmation samples will be collected from one location in the sidewall or base of the column. The sample will be submitted to an off-site laboratory for PCB analysis. Sample analysis will be performed based on a 7-day turn-around. Sample collection and analytical protocols is presented in SAP included in Appendix A. The decontamination process discussed in Section 3.5.1 will be repeated if the PCB concentration in the confirmation sample exceeds the modified action level.

3.6 Removal of Waste and Soil – Former Chip Chute Area

This section presents procedures for excavation and confirmation sampling associated with removal of PCB-contaminated waste and soil located in the former Chip Chute Area. Concrete and soil removal activities will be conducted in accordance with Specification 13284N contained in Appendix C.

3.6.1 Waste and Soil Excavation

In the former Chip Chute area, the waste pile material and approximately 3 feet of the underlying soil will be excavated. The estimated volume of waste material and soil is 74 cubic yards (150 tons).

Contaminated waste and soil will be excavated with the use of a backhoe or excavator situated outside of the Chip Chute. The excavation method may be modified in the field if changes are required to improve efficiency. The excavated waste and soil will be placed directly into a roll-off container designated for TSCA waste. Handling requirements for this material is discussed in Section 3.8.

3.6.2 Soil Confirmation Sampling

Once the waste and soil have been excavated, confirmation samples will be collected from the excavation base and submitted to an off-site laboratory for PCB analysis. Since the excavation will be surrounded by concrete walls and footings, confirmation samples will not be required from the sidewalls of the excavation. Confirmation samples will be collected from two locations within the base of the excavation.

Laboratory analysis will be performed within 7 days of sample collection. If PCB levels in the confirmation samples are less than the modified action level, no further excavation will be conducted. If the PCB levels exceed the modified action, the excavation will be expanded accordingly. The process of excavation and confirmation sampling will be repeated as needed until the confirmation sample results indicate that the PCB concentration has been reduced below the modified action level. Sampling and analytical protocols are presented in the SAP included as Appendix A

3.7 Site Restoration

This sections presents details regarding site restoration in areas where soil and concrete will be removed.

3.7.1 Fencing

To prevent access to open flooring, chain-link fencing will be erected. The fencing will be erected around each open floor area or group of open floors areas such that the fencing is located at least 5 feet from the edge of the floor opening. Warning signs will also be posted to indicate that the open floor area is restricted from entry.

3.7.2 Backfilling of Excavation

Excavation of contaminated soil in the basement, excluding the former Chip Chute Area, will extend to a depth of approximately one foot. Given the limited depth of excavation in these areas, potential future access by persons or equipment should not pose a concern with regard to safety. Therefore, the shallow excavations will not be backfilled.

Excavation of waste and soil in the former Chip Chute Area will extend to a depth of approximately 5 feet below the top of the existing waste pile (approximately 3 feet into the soil underlying the waste pile). It is suspected that groundwater will infiltrate the excavation and result in a pool of standing water. [Note: The presence of groundwater was observed in the boreholes that were made in this area during the site investigation.] To prevent water from pooling in the excavation, the excavation will be backfilled with clean soil or gravel. The fill will be hauled in by truck from an off-site location and placed into the excavation with the use of a backhoe.

3.8 *Material Handing*

This section presents handling requirements for materials that will be generated during the PCB Removal Action at Building 3.

3.8.1 *On-Site Staging*

Materials resulting from the removal activities will be staged at four locations depending on the type of material. The staging areas include the following:

- Staging area at the former Chip Chute
- Staging area on the second floor
- Staging areas at the loading docks
- Staging area for 55-gallon drums

The location of the staging area at the former Chip Chute is shown on Figure 3-1. This staging area will be prepared as discussed in Section 3.1.6 and will be used to stockpile PCB-contaminated concrete rubble and soil, ACM, and cast iron sewer piping from the basement. These materials will be temporarily stockpiled in this staging area awaiting load-out into roll-off containers. Different waste types (i.e. ACM and PCB-contaminated materials) will not be staged in the area at the same time. Polyethylene sheeting will be placed on the ground during the period when the former Chip Chute is used to stockpile the asbestos disposal bags and double-wrapped ACM piping. Once ACM staging is complete, the polyethylene sheeting will be removed and disposed as TSCA waste. Contaminated concrete rubble, soil, and cast-iron sewer piping will be placed directly onto the ground surface while being stockpiled in this staging area.

The staging area on the second floor will be located adjacent to the opening for the former quench tanks (refer to Figure 3-1). The area will be used to stage contaminated concrete slabs removed from the second floor. The slabs will be lifted directly off of the pallet jack with the use of an industrial crane positioned on the first floor. The concrete slab will be lowered to the first floor through the opening in the second floor where the quench tanks were formerly located. The slab will then be placed onto cribbing located on the first floor awaiting transport to the staging areas at the loading docks.

The staging areas at the former loading docks are located at the northeast corner of Building 3 as shown on Figure 3-1. These areas will be used to stockpile PCB-contaminated concrete slabs removed from the first and second floors of the building. The concrete slabs will be placed on cribbing once they arrive at the staging areas awaiting load-out to flatbed trailers for off-site disposal.

A 55-gallon drum staging area will be established in the former garage area (refer to Figure 3-1). This area will be used to stage drums filled with liquid waste, including cooling water from concrete saw cutting, equipment decontamination water, cooling water from concrete coring operations, and liquid waste from the concrete column decontamination process. As a means of secondary containment, the drum staging area will be lined with 6-mil polyethylene sheeting and surrounded with absorbent booms. The approximate dimensions of this area will be 20 feet by 40 feet. Drums containing soil mixed with ACM will be stored in an area of the building near the former garage. However, since these drums contain solid materials that do not pose a spill or leak concern, they will not be stored within a secondary containment. All drums will be labeled to indicate the contents, origin of the materials, and contact information. The contents of the drums will be sampled during the Removal Action to determine the proper disposal method. The sample collection and analytical protocols are discussed in the SAP included as Appendix A.

3.8.2 Load-Out

The asbestos disposal bags and the double-wrapped asbestos piping in the staging area at the former Chip Chute will be loaded by hand into 40-cubic yard enclosed roll-off containers (designated for ACM) stationed outside of the former Chip Chute. The roll-off container will be loaded from the open end of the container.

PCB-contaminated concrete rubble and soil from the basement will be loaded with the use of an excavator into 40-cubic yard roll-off containers (designated for TSCA waste). The excavator will be stationed outside of the staging area at the former Chip Chute area in the basement. The roll-off containers will be filled with approximately 17 tons of rubble or soil. A canvass tarp will be placed over the top of the roll-box at all times except during active load out. When in use, the tarp will be secured to the sides of the container.

Contaminated concrete slabs will be loaded onto a flatbed trailer with the use of a telescopic handler (fork lift). The slabs will be placed on cribbing and double-wrapped with 6-mil polyethylene sheeting. No greater than 22 tons of concrete slabs will be loaded onto the trailer. Once the slabs are loaded, a canvass tarp will be placed over the slabs and secured to the trailer for off-site shipment.

Waste generated from personal protective equipment (PPE) disposal (i.e. boot covers, disposable coveralls, HEPA filters, gloves) and other special wastes (such as absorbent mats and booms) with PCB concentrations < 50 ppm will be placed into a 20-cubic yard enclosed roll-off container. The container will be labeled as "Special Waste Only."

General refuse will be placed into a municipal trash container or dumpster. The container will be labeled as "General Refuse Only." The proposed locations for each type of waste container are shown on Figure 3-1.

Waste materials contained in 55-gallon drums (such as liquids from the concrete column decontamination process and soil mixed with ACM) will be staged inside the building within or near the former garage area as discussed in Section 3.8.1. The drums will be loaded out (with the use of a drum dolly and/or forklift with a drum attachment) into tractor/trailer for shipment to an off-site disposal facility.

3.8.3 Off-Site Transportation and Disposal

This section presents the details associated with off-site transportation and disposal of TSCA waste, ACM waste, and special waste. Following load-out, flatbed trailers and roll-off containers containing PCB-contaminated materials will be transported to a TSCA-certified disposal facility. Roll-off containers containing "special waste" and ACM will be transported to a municipal landfill licensed by the state to accept such waste material. Transportation and disposal of waste materials generated during the project will be performed in general accordance with Specification 02120A contained in Appendix C. Transportation activities will comply with Department of Transportation (DOT) standards and applicable state and local transportation regulations. Off-site shipments of waste materials will be packaged, marked, labeled, and placarded in accordance with 49 CFR Parts 172 and 173. The commercial carrier of waste materials destined for disposal shall comply with Federal Motor Carrier Safety Regulations (FMCSRs). When transporting materials classified as hazardous under DOT 49 CFR Part 172, carriers shall be certified by the Federal Motor Carrier Safety Administration. Transport vehicles shall be in good condition, safe to operate, and compliant with Federal Motor Vehicle Safety Standards (49 CFR Part 571). The gross weight of transport vehicles shall not exceed state limits. Off-site shipments shall be accompanied by the required shipping documents, including manifests and/or bill-of-ladings. Disposal of PCB-contaminated waste will be preformed in accordance with 40 CFR 761. A

USACE representative will sign all waste shipping manifests. As required under TSCA, the receiving facility shall provide "certificates of disposal."

3.9 Field Documentation

This section presents details regarding field documentation of removal activities. Field documentation associated with sampling and analysis (sample labeling, sample collection field sheets, chain-of-custody, etc.) is discussed in the SAP included as Appendix A. Field documentation associated with quality control and corrective action (inspection checklists, daily quality control reports, field work variances, etc.) are discussed in Section 6.0. Field documentation associated with health and safety activities (air monitoring log, site entry log, equipment safety inspection checklists, etc.) is addressed in the SHERP included as Appendix B.

3.9.1 Field Logbook

Field logbooks will be maintained to record all pertinent information. Entries will be as descriptive and detailed as possible so that a particular situation can be reconstructed without reliance on the collector's memory. Field logbooks will be maintained by the Field Supervisor.

The cover of each field logbook will contain the following information:

- Project name and number
- Book number
- Activity type
- Start date
- Stop date.

Entries to a field logbook will be made daily and, at a minimum, will consist of the following:

- Date
- Start time
- Weather
- All field personnel present
- Visitors to the site (time, name, and company)
- Level of personnel protection used
- Activities conducted
- Air monitoring readings, if applicable
- Pertinent field observations
- Field measurements, if applicable
- Description of all related activities

- Signature of the person making the entry.

All entries will be made in indelible ink. No erasures are permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark and initialed. Entries will be organized into easily understandable tables, if possible.

3.9.2 Photographs

Color digital photographs will be taken prior to, during, and after conducting field activities. Photographs will be tracked with a numbered photograph log that will include the project name, date, and description of activity or location.

3.9.3 Recordkeeping

During the removal action, pertinent records will be maintained in a secure file located in the field administration office. These records include, but are not limited to, the following:

- Waste shipment manifests, bill-of-ladings, or other shipping documents
- Contract documents
- Procurement records (i.e. purchase orders)
- Receipts for delivery of materials and equipment
- Equipment maintenance records
- Equipment operator certificates
- Logbooks
- Photographs
- Project correspondence
- Training records
- Medical surveillance records
- Quality control records (refer to Section 6.0)
- Sample collection and analytical records and data (refer to SAP, Appendix A)
- Health and safety records (refer to SHERP, Appendix B)

4.0 Regulatory Requirements

The regulatory requirements or standards applicable to the Removal Action are presented in Tables 4-1, 4-2, and 4-3. This information was compiled by reviewing federal, state, and local environmental statutes in general accordance with the ARAR (applicable and relevant and appropriate requirements) process under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Although SLAAP is not a CERCLA site, the process for identifying ARARs under CERCLA provides a convenient framework with which to identify the applicable standards. In general, the Removal Action will attain or exceed ARARs to the maximum extent practicable. There are three different types of ARARs to be considered for the Removal Action. Contaminant-specific ARARs are health or risk-based concentration limits for contaminants in various environmental media or an acceptable level of discharge if the discharge occurs as part of the Removal Action. Action-specific ARARs are controls on the removal activities. They may be established based on performance levels, actions, technologies as well as specific levels for discharged or residual contaminants. Location-specific ARARs are restrictions on the concentration of hazardous substances or on conducting activities due to the specific location of the Removal Action.

5.0 Site Safety and Health

All work activities will be performed using safe working practices a detailed in the Safety Health and Emergency Response Plan (SHERP) included as Appendix B. Field personnel working on the Removal Action will become familiar with and follow the protocols outlined in the SHERP.

6.0 Contractor Quality Control

This section provides the criteria for the performance of inspections of each Definable Feature of Work (DFW) associated with the Removal Action. Inspections are the processes whereby the Quality Control (QC) Inspector, by examination or measurement, determines that an activity complies with the specified quality requirements. The inspection system is based on the USACE three-phase system of control to cover the activities. The three-phase inspection system consists of preparatory, initial, and follow-up inspections for applicable DFWs.

6.1 Definable Features of Work

A DFW is defined as a major work element that must be performed in order to execute and complete the project. It consists of an activity or task that is separate and distinct from other activities and requires separate control. The following DFWs have been identified for the planned field activities:

- Site preparation
- Pipe and asbestos removal
- Preparation of staging areas
- Removal of concrete flooring (first and second floors)
- Removal of concrete flooring (basement)
- Removal of soil (basement)
- Column decontamination
- Removal of waste in the Chip Chute
- Site restoration
- Material handling
- Transportation and disposal

6.2 QC Inspections

The QC Inspector will coordinate inspection activities with the Project Manager/Field Supervisor, subcontractors, and field personnel. Inspection activities will be performed on a daily basis.

6.2.1 Preparatory Inspections

Preparatory inspections will be performed prior to the initiation of all DFWs. The preparatory inspection is performed in advance of any work being performed to determine whether or not everything is properly in place and ready to initiate the work activity. This inspection will be conducted by the QC Inspector and will be attended by field personnel and subcontractors. The preparatory inspection will be scheduled prior to the start of the DFW. All affected parties will be notified in advance of the inspection to coordinate their participation. The preparatory inspection will include, but is not limited to:

- Review of pertinent contract requirements and plans
- Review of required control inspections and test requirements
- Review of reports, forms, and checklists that need to be filled out during the activity
- Review of subcontracts and purchase orders
- Review of required licenses, permits, and certifications
- Establish that required planning documents have been reviewed and approved by USACE and regulators
- Establish that the required materials and equipment for commencement of the DFW are on-hand, available, in working order, and are in accordance with plans and calibration requirements
- Establish that the preliminary work required to begin the DFW is complete and conforms to approved plans
- Schedule the date that the initial inspection, if required, will be performed
- Review and discuss the SHERP requirements for the DFW.

The preparatory inspection checklist is included in Appendix E.

6.2.2 Initial Inspections

Initial inspections will be conducted at the initiation of a DFW. The initial inspection will provide the opportunity for the QC Inspector to observe the actual initiation of the work activity and the individual segments of the DFW. The inspection will be performed on a representative sample of work to evaluate the following criteria:

- Compliance with the work plans and other contract requirements
- Acceptable levels of workmanship
- Proper operation of equipment
- Identify use of defective or damaged materials
- Identify improper procedures or methods
- Acceptable test or inspection results
- Compliance with the SHERP
- Completion or collection of pertinent records

The initial inspection checklist is included in Appendix E.

6.2.3 Follow-Up QC Inspections

Follow-up QC inspections of field activities will be performed on a daily basis when work on a DFW is in progress. The Daily QC inspections will be performed until all work on a DFW is completed. The following items will be performed during the Daily QC inspection:

- Verify compliance with the plans and other contract requirements
- Verify proper operation of equipment
- Verify level of workmanship, if applicable
- Verify test or inspection results
- Verify nonconformance issues are identified, corrected, and re-inspected
- Verify compliance with the SHERP
- Verify completion or collection of pertinent records

The follow-up inspection checklist is included in Appendix E.

6.2.4 QC Inspection Documentation

The preparatory, initial, and follow-up inspections will be documented on forms. Preparatory, initial and daily QC inspection checklists are provided in Appendix E. The daily QC inspection checklist will be attached to the Daily Quality Control Report (DQCR) (refer to Section 6.3) and submitted to the USACE on a daily basis during the Removal Action.

6.3 Daily QC Reports

DQCRs will be prepared to document field activities performed. Quality control personnel will prepare DQCRs with input from the Field Supervisor, sampling personnel, and others conducting the field activities. The DQCRs will contain the following information pertaining to the field activities:

- Weather information
- Equipment usage
- Quantities of work completed
- Results of confirmation sampling
- Field instrument measurements
- Verbal instructions received from CENWK or AMCOM personnel
- Problems encountered during field work
- Field Work Variances
- Applicable forms, logs, and checklists included in this work plan.

6.4 Correction Actions

Corrective actions will be implemented to correct nonconformances identified during QC inspections or during the course of conducting activities. A nonconformance is defined as a deficiency in implementation of a procedure or standard that renders the quality of an item or activity unacceptable or indeterminate with respect to the acceptability criteria. Correction of nonconformances will focus on determining the cause of the deficiency and instituting actions to correct the deficiency and prevent recurrence.

Corrective actions will be implemented and documented via a Corrective Action Report (CAR) (refer to Appendix E). No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are deemed insufficient, work may be stopped through a stop-work order issued by the Contractor Project Manager and/or the CENWK Project Manager

6.4.1 Nonconformance Reporting

Noncompliance with specified criteria will be documented through a formal nonconformance control and corrective action program. Personnel who identify a nonconformance are responsible for notifying the Contractor Project Manger of the nonconformance. The Contractor Project Manager will discuss the nonconformance with USACE on-site representative to determine if the nonconformance has been properly described and that applicable project requirements or criteria have not been met to warrant issuance of a Non-Conformance Report (NCR) (refer to Appendix E). The Contractor Project Manager will immediately notify the CENWK Project Manager of any major or critical deficiencies identified during the course of project execution.

6.4.2 Nonconformance Disposition and Tracking

Corrective actions required to bring nonconforming conditions into compliance will be approved by the Contractor Project Manager prior to implementation. Corrective actions will be documented in a field CAR, which will be attached to DQCR. NCRs will remain on open status and tracked until the corrective actions have been implemented and verified acceptable by the Contractor Project Manager. If appropriate, the Contractor Project Manager will ensure that no additional work associated with the nonconforming activity is performed until the corrective actions are completed. This will be implemented through a stop-work order issued by the Contractor Project Manager.

6.4.3 *Field Work Variances*

Changes to approved plans or procedures may be implemented based on unanticipated field conditions or determination of improved field methods. Request for approval to vary from approved plans, specifications or procedures will be submitted to the CENWK with a Field Work Variance (FWV) (refer to Appendix E). Minor variances can be implemented in the field prior to receipt of written approval of the FWV when approved by the USACE on-site representative. Minor variances are defined as those variances that do not affect project cost, schedule, quality or quantities. Major variances require written approval prior to implementation. Major variances impact cost, schedule, quality, and quantities and vary from the approved plans, specifications, or procedures. FWVs will be submitted to the USACE Contracting Officer Representative (COR) for approval.

7.0 Project Schedule

The Removal Action at Building 3 will begin on November 12, 2001 and is scheduled to be completed by February 21, 2002. A draft Removal Action Report will be distributed for review by March 19, 2001. The anticipated schedule of all the activities is presented in Figure 7-1.

Fieldwork will generally consist of 11 consecutive work days followed by a 3-day break. This schedule will be modified to accommodate breaks occurring during the holidays (Thanksgiving, Christmas, and New Years). Work will be conducted from approximately 7 AM to 7 PM each day.

8.0 References

Arrowhead Contracting, Inc. 2001a. *Alternatives Evaluation for Removal of PCBs. St. Louis Army Ammunition Plant, St. Louis, Missouri.* March.

Arrowhead Contracting, Inc. 2001b. *Sampling and Analysis Plan, Determination of PCB TSCA Waste Quantities, Building 3. St. Louis Army Ammunition Plant, St. Louis, Missouri.* June.

Arrowhead Contracting, Inc. 2001c. *Field Investigation Report, Determination of PCB TSCA Waste Quantities, Building 3. St. Louis Army Ammunition Plant, St. Louis, Missouri.* November.

Tetra Tech EM. Inc.. 2000. *Final Environmental Baseline Survey Report, Saint Louis Army Ammunition Plant, St. Louis, Missouri.* December.

REPLACEMENT TABLES - RA WORK PLAN

Table 1-1

Summary of Project Organization and Responsibilities

KEY PERSONNEL	ORGANIZATION	ROLE	RESPONSIBILITIES
Sandy Olinger	AMCOM	Project Manager	• Contract management
George Wade Heather Black	SEMCOR	Technical Consultants	• Technical consultant to AMCOM
Brad Eaton	CENWK	Project Manager	• Technical oversight • Right of entries • Management of CENWK technical personnel • Oversight of Arrowhead Contract
David Cox	U.S. Army, Fort Leonard Wood	Contracting Officer Representative	• Contract administration
Jean Jennings	CENWK	Contracting Officer	• Contract administration
Bonnie Lowe	CENWK	Contracting Specialist	• Contract administration
Ray Allison	U.S. Army, Fort Leonard Wood	USACE Oversight	• Perform periodic field oversight of RA activities
Dan Mitchell	CENWK	Health & Safety	• CENWK H&S Oversight
Francis Zigmund	CENWK	Project Chemist	• Chemistry oversight
Kurt Baer	CENWK	Project Engineer	• Technical oversight
Laura Percifeld	CQAB	Laboratory Supervisor	• QA sample analysis • Assign LIMS number for off-site analysis
Greg Wallace	Arrowhead	Project Manager/Field Supervisor	• Primary contact point with CENWK and AMCOM • Overall responsibility for all phases of work • Oversight of field activities • Technical direction to field subcontractors and field personnel
Scott Siegwald	Arrowhead	Site Health and Safety Officer and QA/QC Manager	• Directing overall chemical QA\QC program • Oversight of site health and safety program • Oversight of off-site Chemical Laboratory • Coordination with CQAB • Preparation of Daily Quality Control Reports • Sample packaging and

KEY PERSONNEL	ORGANIZATION	ROLE	RESPONSIBILITIES
			shipping • Preparation of report
Kerry Pruett Randy Glover	Arrowhead	Heavy Equipment Operators	• Operation of heavy equipment in support of concrete, waste, and soil removal, staging, and load-out • Site Layout
Ben Williams Andy Arnold Aaron Mathena Doug Ronk	Arrowhead	Environmental Technicians	• Site layout • Concrete, waste, soil , asbestos, and pipe removal • Preparation of sample for off-site analysis • Collection of field QA/QC samples • Decontamination
Leland Sumptur	Asbestos Consulting and Testing (ACT)	Air Sampling Professional, Project Manager	• Floor cleaning (vacuuming) in basement • Assistance during ACM and pipe removal in basement • Air sampling during abatement activities
Rocky Griffonetti	Concrete Coring Company of St. Louis	Project Manager	• Saw-cutting of concrete slabs on first and second floors • Removal of outside wall
Brian Erskine	EQ – The Environmental Quality Company	Project Manager	• Transportation and disposal of PCB-contaminated wastes
Kendall Lindquist Scott Meeks	Analytical Management Laboratories (AML)	Analytical laboratory for off-site analysis of PCB and other environmental samples	• Chemical analysis • Laboratory QA/QC • Raw data summary report

Note: Any changes in personnel assignments are subject to CENWK approval.

Table 2-1
Estimate of TSCA Waste Quantities

Location	Media	Description of PCB Contamination (>43.5 PPM)		TSCA Waste Area (sq. ft)	TSCA Waste Avg. Depth (In.)	TSCA Waste Volume (cu. ft)	TSCA Waste Quantity (tons)	Overage* (tons)	Total TSCA Waste Quantity (tons)
First Floor	Concrete Flooring	21.5 sectors and 27 quadrants within former process and traffic areas	20.5 sectors (8 in.)	8,200	8	5,467	506	0	506
			19 quadrants (8 in.)	1,900	8	1,267	117	39	156
			1 sector (16 in.)	400	16	533	49	25	74
			7 quadrants (16 in.)	700	16	933	86	76	162
Second Floor	Concrete Flooring	3 sectors and 10 quadrants within former process areas	3 sectors (8 in.)	1,200	8	800	74	0	74
			10 quadrants (8 in.)	1,000	8	667	62	20	82
Basement	Concrete Flooring	Elongated area between Rows 20 and 21; area surrounding Sector G11; Sector B17, adjacent to Chip Chute; and small area within Sector B13	Rows 20 - 21	2,800	6	1,400	130	0	130
			Sector B17	400	6	200	19	0	19
			Around Sector G11	1,500	6	750	69	0	69
			Sector B13	200	6	100	9	0	9
Basement	Soil Flooring	5 areas around perimeter (south and west) of concrete floor; also, flooring beneath Chip Chute waste pile	Area A	600	12	600	36	0	36
			Area B	130	12	130	8	0	8
			Area C	160	12	160	10	0	10
			Area D	140	12	140	8	0	8
			Area E	80	12	80	5	0	5
			Chip Chute Flooring	400	36	1,200	72	0	72
Outside, near Chip Chute	Soil, Pavement	Two areas adjacent to Building 3, north of Chip Chute near loading dock; includes asphalt and gravel overlying native soil	Soil and Gravel	2,200	60	11,000	660	0	660
			Asphalt	2,200	4	733	37	0	37
Chip Chute Waste Pile	Waste	20 ft x 20 ft pile of misceallaneous metal shavings and debris, average depth 2 ft	Waste pile	400	24	800	60	0	60
Basement	Concrete Columns	6 oil-stained columns located within areas of concrete flooring contamination	6 columns	230	1	NA	NA	NA	NA
TOTALS							**2,016**	**160**	**2,176**

Notes:

* To prevent the creation of unsupported (cantilevered) floor slabs during removal, saw cut lines will extend beyond the limits of contamination to the nearest support beam or to within 2.5 ft. of the nearest row of vertical columns.

It is not anticpated that TSCA waste soil outside the building will be removed during the upcoming remedial action. Thus, total TSCA waste quantity for the remedial action is estimated to be 1,479 tons.

PCB-contaminated concrete columns will not be removed; rather, contaminated portions of the columns will be cleaned using a chemical washing process.

Table 2-2
Results of Removal Action Waste Pre-Determination Sampling - TCLP Metals and SVOCs

Sample ID	Media	Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver	Mercury	SVOCs
CF1C23-01C	Concrete	ND	0.64	ND	0.03	ND	ND	ND	ND	ND
SS230018	Soil	ND	0.39	0.07	ND	0.16	ND	ND	ND	ND
SS430036	Soil	0.22	1.2	ND	ND	ND	ND	ND	ND	ND
CB020012	Waste	0.20	0.23	ND	ND	0.17	ND	ND	ND	ND
WP020024	Waste	0.15	0.61	ND	ND	ND	ND	ND	ND	ND
TCLP Limit		**5**	**100**	**1**	**5**	**5**	**5.7**	**5**	**0.2**	**---**

Notes: All units are mg/L (milligrams per liter)

ND = Not detected above method detection limit or reporting limit

SVOCs = Semivolatile organic compounds

TCLP = Toxicity Characteristic Leaching Procedure

Table 2-3
Results of Removal Action Waste Pre-Determination Sampling - GROs, DROs, VOCs

Sample ID	Media	Units	DROs	GROs	VOCs
CF1C23-01C	Concrete	mg/kg	413	---	---
SS230018	Soil	mg/kg	53	---	---
SS403640	Soil	mg/kg	325	ND	---
SS430036	Soil	mg/kg	188	ND	---
CB020012	Waste	mg/kg	723	ND	---
WP020024	Waste	mg/kg	1122	ND	---
SS45L	Groundwater	mg/L	5.57	ND	ND

ND = Not detected above method detection limit or reporting limit

DROs = Diesel range organics

GROs = Gasoline range organics

VOCs = Volatile organic compounds

mg/kg = milligrams per kilogram

mg/L = milligrams per liter

Table 3-1
Concrete Floor Removal Quantities - First and Second Floors

First Floor

Section	No. of Slabs	Slab Area	Floor Thickness	lbs/cuft	Weight (lbs) per Section	Weight (tons) per Section	Slab Weight (tons)	No. of Core Holes per Section	Linear Ft. of Saw Cutting per Section
G30	12	33.33	0.67	185	49,333	24.7	2.06	24	180
H29	8	33.33	0.67	185	32,889	16.4	2.06	16	170
G29	8	33.33	0.67	185	32,889	16.4	2.06	16	170
G28	12	33.33	0.67	185	49,333	24.7	2.06	24	70
F24	4	33.33	0.67	185	16,444	8.2	2.06	8	170
E24	12	33.33	0.67	185	49,333	24.7	2.06	24	160
D24	12	33.33	0.67	185	49,333	24.7	2.06	24	160
C24	12	33.33	0.67	185	49,333	24.7	2.06	24	60
B24	4	33.33	0.67	185	16,444	8.2	2.06	8	87
F23	6	33.33	0.67	185	24,667	12.3	2.06	12	150
E23	12	33.33	0.67	185	49,333	24.7	2.06	24	140
D23	12	33.33	0.67	185	49,333	24.7	2.06	24	140
C23	12	33.33	0.67	185	49,333	24.7	2.06	24	60
F22	4	33.33	0.67	185	16,444	8.2	2.06	8	70
A19	4	33.33	0.67	185	16,525	8.3	2.07	8	70
K18	8	25.00	1.33	185	49,333	24.7	3.08	16	110
	13	12.50	1.33	185	40,083	20.0	1.54	26	103
H18	16	25.00	1.33	185	98,667	49.3	3.08	32	200
	16	12.50	1.33	185	49,333	24.7	1.54	32	130
F18	8	25.00	1.33	185	49,333	24.7	3.08	16	110
	13	12.50	1.33	185	40,083	20.0	1.54	26	103
J17	4	25.00	1.33	185	24,667	12.3	3.08	8	60
	7	12.50	1.33	185	21,583	10.8	1.54	14	53
K16	12	33.33	0.67	185	49,333	24.7	2.06	24	180
J16	12	33.33	0.67	185	49,333	24.7	2.06	24	145
H16	12	33.33	0.67	185	49,333	24.7	2.06	24	160
K15	4	33.33	0.67	185	16,444	8.2	2.06	8	57
J15	12	33.33	0.67	185	49,333	24.7	2.06	24	160
H15	12	33.33	0.67	185	49,333	24.7	2.06	24	140
G15	4	25.00	1.33	185	24,667	12.3	3.08	8	60
	7	12.50	1.33	185	21,583	10.8	1.54	14	53
K14	8	33.33	0.67	185	32,889	16.4	2.06	16	140
J14	12	33.33	0.67	185	49,333	24.7	2.06	24	150
H14	12	33.33	0.67	185	49,333	24.7	2.06	24	140
D14	4	25.00	1.33	185	24,667	12.3	3.08	8	60
	9	12.50	1.33	185	27,750	13.9	1.54	18	75
H13	12	33.33	0.67	185	49,333	24.7	2.06	24	160
K12	8	33.33	0.67	185	32,889	16.4	2.06	16	127
H12	8	33.33	0.67	185	32,889	16.4	2.06	16	127
H11	12	33.33	0.67	185	49,333	24.7	2.06	24	167
J10	4	33.33	0.67	185	16,444	8.2	2.06	8	70
H10	8	33.33	0.67	185	32,889	16.4	2.06	16	117
J9	8	33.33	0.67	185	32,889	16.4	2.06	16	114
H9	12	33.33	0.67	185	49,333	24.7	2.06	24	147
Totals	**411**				**1,713,386**	**856.7**		**822**	**5,271**

Second Floor

Section	No. of Slabs	Slab Area	Floor Thickness	lbs/cuft	Weight (lbs) per Section	Weight (tons) per Section	Slab Weight (tons)	No. of Core Drill Holes per Section	Linear Ft. of Cutting per Section
H24	4	33.33	0.67	185	16,444	8.2	2.06	8	70
F24	4	33.33	0.67	185	16,444	8.2	2.06	8	70
H22	4	33.33	0.67	185	16,444	8.2	2.06	8	70
C19	4	33.33	0.67	185	16,444	8.2	2.06	8	70
H13	8	33.33	0.67	185	32,889	16.4	2.06	16	140
F13	4	33.33	0.67	185	16,444	8.2	2.06	8	70
E13	12	33.33	0.67	185	49,333	24.7	2.06	24	180
D13	12	33.33	0.67	185	49,333	24.7	2.06	24	160
C13	12	33.33	0.67	185	49,333	24.7	2.06	24	160
D12	4	33.33	0.67	185	16,444	8.2	2.06	8	57
H11	4	33.33	0.67	185	16,444	8.2	2.06	8	70
D11	4	33.33	0.67	185	16,444	8.2	2.06	8	70
Totals	**76**				**312,444**	**156.2**		**152**	**1,187**

Note: Shaded area represents 16-in. concrete flooring supported by vertical columns.

Table 4-1
Chemical-Specific Regulatory Requirements

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Toxic Substances Control Act (TSCA)	40 CFR 761.61	Establishes standards for disposal of "PCB remediation waste" based on the PCB concentration and type of waste.	Wastes associated with the Building 3 removal action are classified as one of the following types: • Bulk PCB remediation wastes (>50 ppm); herein referred to as "TSCA waste" • Porous surfaces (>50 ppm); herein referred to as "TSCA waste" • Cleanup wastes Cleanup wastes are wastes derived from the cleanup of PCBs, including non-liquid cleaning materials (i.e. rags, gloves), PPE, and non-porous surfaces.
Resource Conservation and Recovery Act (RCRA)	40 CFR Part 261	Establishes procedures for determining whether a solid waste is classified as a hazardous waste.	If any waste material derived from the removal action contains a regulated contaminant(s) at a concentration above the TCLP level, the waste will be classified as a hazardous waste. [Note: This standard is not applicable. Waste materials generated during the removal action are not anticipated to be a hazardous waste based on the results of waste profile sampling and analysis conducted during the field investigation.]

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Clean Air Act, National Emission Standards for Hazardous Air Pollutants (NESHAP) - Asbestos	40 CFR Part 61, Subpart M	Establishes standards for renovation activities involving asbestos.	Pipe insulation and loose asbestos in the basement is classified as regulated asbestos-containing material (RACM).

Table 4-2
Action-Specific Regulatory Requirements

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Toxic Substances Control Act (TSCA)	40 CFR 761.61	Provides cleanup and disposal options for PCB remediation waste from "self-implementing on-site clean up" operations.	Disposal options for bulk PCB remediation wastes and porous surfaces containing PCBs > 50 ppm (i.e. "TSCA wastes") include a RCRA-permitted hazardous waste landfill or an approved PCB landfill. Disposal options for PCB remediation wastes < 50 ppm and cleanup wastes (i.e. PPE, non-liquid materials, non-porous surfaces) include: • Municipal solid waste landfill • Non-municipal, non-hazardous waste landfill • Hazardous waste landfill • PCB disposal facility Municipal or non-industrial, non-hazardous landfills must be permitted and licensed by the State to accept low levels of PCBs.
Toxic Substances Control Act (TSCA)	40 CFR 761.65	Establishes standards for temporary storage of PCB waste greater than 50 ppm.	This subsection is not currently applicable. TSCA wastes removed from Building 3 will not be stored on-site.

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Toxic Substances Control Act (TSCA)	40 CFR 761.202 – 761.218	Identifies various recordkeeping and reporting requirements for PCB waste generators, transporters, and disposal facilities.	Provisions applicable to the removal action include the use of waste shipping manifests (EPA Form 8700-22), exception reporting (as necessary), and the preparation of Certificates of Disposal by the disposal facility.
Toxic Substances Control Act (TSCA)	40 CFR 761.40 and 761.45	Establishes marking requirements for PCBs.	All "containers" (any package, drum, tank, etc. that has been in direct contact with PCBs) and storage areas must be marked in accordance with this standard.
Toxic Substances Control Act (TSCA)	40 CFR 761.75	Establishes standards for chemical waste landfills.	The facility selected for disposal of remediation waste and porous surfaces >50 ppm must meet applicable criteria.
Occupational Safety and Health Act - Asbestos	29 CFR 1910.1926.1101	Specifies engineering controls, work practices, and other related requirements for asbestos work, including demolition and removal operations.	The removal of loose asbestos and pipe insulation in the basement will constitute "Class I asbestos work."
Clean Air Act, National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR Part 61 (61.145)	Establishes standards, including notification and asbestos emission control procedures, for renovation activities involving regulated asbestos containing material (RACM).	The removal of loose asbestos and pipe insulation in the basement will constitute a renovation (i.e. stripping or removal of RACM) since the total quantity of asbestos will exceed 260 linear feet.

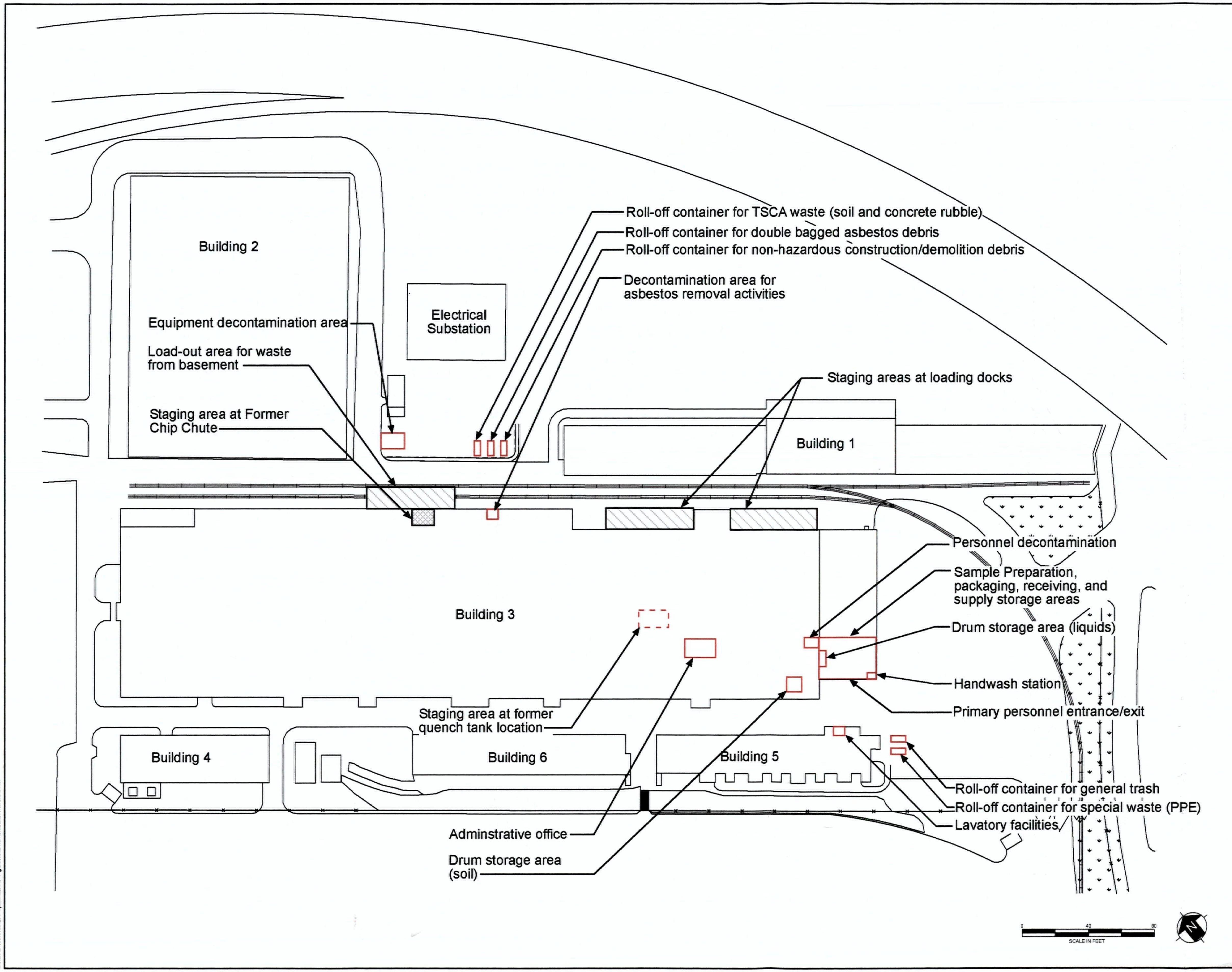
Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Hazardous Materials Transportation Act (HMTA) – Hazardous Materials Transportation Regulations	49 CFR Parts 107, 171 – 180	Regulates the transportation of hazardous materials.	Shipments of PCB wastes for off-site disposal must meet applicable DOT requirements, including labeling, marking, and placarding.
Occupational Safety and Health Act – Construction Standards	29 CFR 1926, Subparts A - Z	Establishes safety and health standards for construction work.	Safety provisions applicable to the removal action include, but are not limited to: • Hand and power tools (Subpart I) • Electrical (Subpart K) • Fall protection (Subpart M) • Motor vehicles and mechanized equipment (Subpart O) • Demolition (Subpart T).
Occupational Safety and Health Act –General Industry Standards	29 CFR 1910, Subparts A - Z	Establishes safety and health standards for general industry.	Safety provisions applicable to the removal action include, but are not limited to: • Walking-working surfaces (Subpart D) • Hazardous materials (Subpart H) • Personal protective equipment (Subpart I) • Materials handling and storage (Subpart N) • Machine guarding (Subpart O) • Hand and portable powered tools (Subpart P)

Table 4-3
Location-Specific Regulatory Requirements

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Missouri Code of Sate Regulation (CSR) – Asbestos	10 CSR 10-6.240 and .250	Establishes requirements – including registration, notification, performance standards, and training – for asbestos abatement projects in Missouri.	The State of Missouri will need to be notified (using form MO 780-1226) of the asbestos removal (abatement) project in the basement. Only Missouri-certified asbestos supervisors and workers may conduct asbestos removal.
City of St. Louis, Division of Air Pollution Control	(Adopts 40 CFR Part 61)	Requires notification for asbestos work within the City of St. Louis.	The City of St. Louis Air Program must be notified of asbestos abatement activities using Missouri Form MO 780-1226.
Missouri Code of Sate Regulation (CSR) – Special Waste	10 CSR 80-2.010	Identifies "special waste" as non-hazardous waste which, due to it physical or chemical characteristics, potentially requires special handling and disposal	The municipal landfill and/or construction landfill selected for disposal of non-hazardous/cleanup waste may require a special waste permit if the waste potentially contains PCBs or other contaminants. Special wastes associated with the removal action may include miscellaneous debris (i.e. bricks, pipe) and PPE.
Missouri Revised Statutes – Traffic Regulations	RSMo 304.180	Establishes truck weight limits for highway transportation.	Trucks transporting PCB wastes to the TSCA disposal facility must meet state gross weight limits.

Standard, Requirement, Criteria, or Limitation	Citation	Description	Comment
Municipal Landfill Operating Permits – for municipal solid waste landfills serving the St. Louis metropolitan area	(Facility-specific)	Municipal landfill permits (issued by the State in which the facility is located) specify the types of wastes that are not authorized for disposal.	Various landfills in and around St. Louis may be prohibited from accepting wastes containing or potentially containing PCBs. Facilities that will accept PCB waste (<50 ppm) may require that a special waste permit be obtained by the generator. These and other special provisions may affect the selection of a disposal facility for miscellaneous wastes (i.e. bricks, pipe, PPE) derived from the removal action.

REPLACEMENT FIGURES - RA WORK PLAN

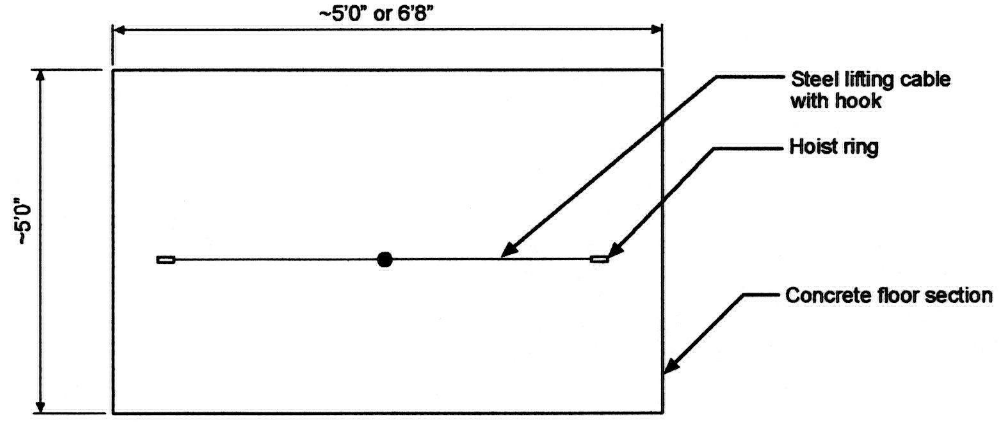


St. Louis Army Ammunition Plant, Building 3
St. Louis, Missouri

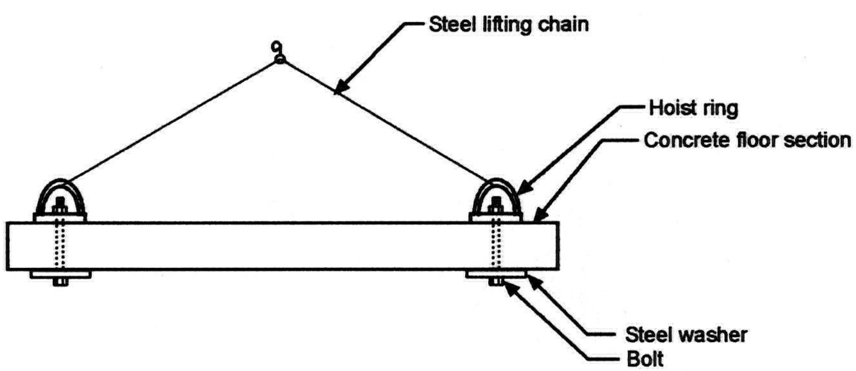
Figure 3-1
Site Adminstration Areas

Arrowhead Contracting, Inc.

Date: 8/31/01	Project No.: 00-215 SLAAP Building 3	Checked By: GWW	Drawn By: DLR



Plan View



Cross-Section

St. Louis Army Ammuntion Plant, Building 3
St. Louis, Missouri

Figure 3-10
Hoist Ring and Lift Cable Detail

Arrowhead Contracting, Inc.

Date: 8/31/01	Project No.: 00-215 SLAAP Building 3	Checked By: GWW	Drawn By: DLR

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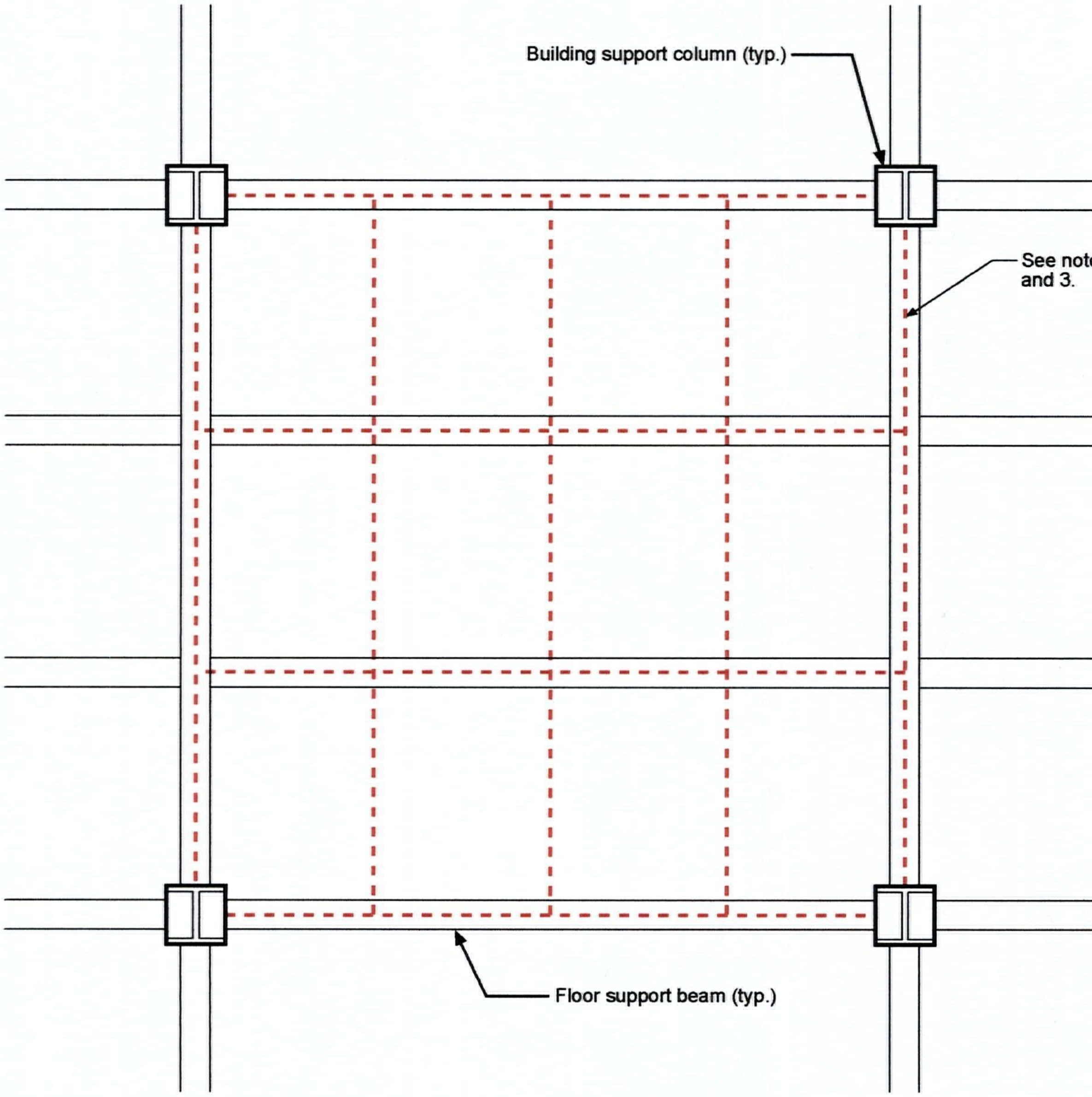

Legend:

- - - - Cut line for areas requiring removal

Notes:

1. The concrete floor will be cut along the centerline of each horizontal floor support beam. In cases where only one quadrant will be removed from a sector, the concrete will be removed to the nearest beam outside of the area of contamination.
2. Sectors requiring complete removal of concrete floor will be removed in twelve sections.

0 10

SCALE IN FEET

St. Louis Army Ammunition Plant, Building 3
St. Louis, Missouri

Figure 3-11
Cut Detail for Concrete Supported by Horizontal Floor Beams

Arrowhead Contracting, Inc.

Date: 8/31/01 | Project No.: 00-215 SLAAP Building 3 | Checked By: GWW | Drawn By: DLR

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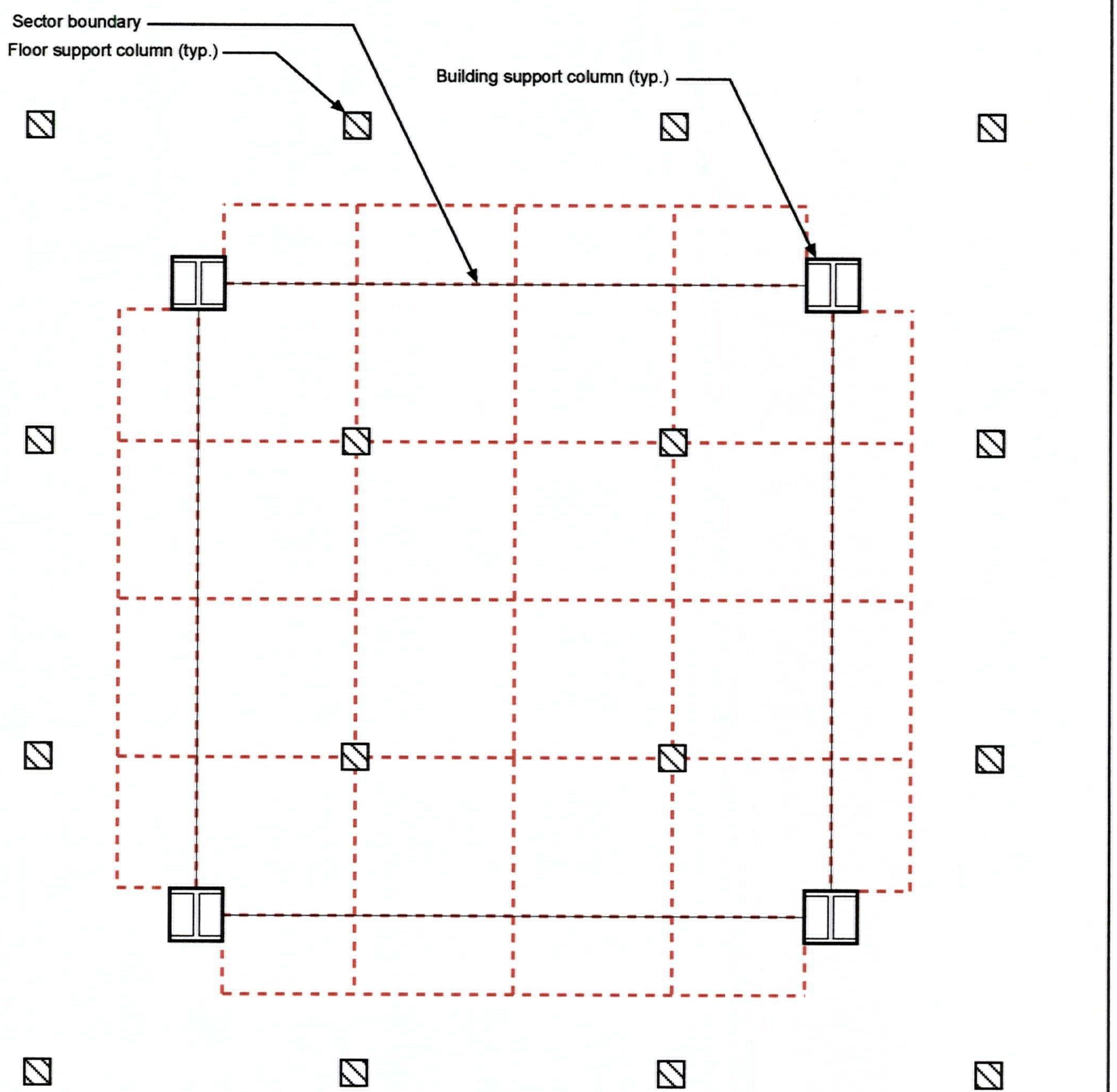

Legend:

- - - - Cut line for areas requiring removal

Note:
Sectors where the removal of only one quadrant is required will require concrete removal to the nearest support column located outside the area of contamination.

0 10
SCALE IN FEET

St. Louis Army Ammunition Plant, Building 3 St. Louis, Missouri
Figure 3-12 Cut Detail for Concrete Supported by Concrete Columns
Arrowhead Contracting, Inc.

Date: 8/31/01	Project No.: 00-215 SLAAP Building 3	Checked By: GWW	Drawn By: DLR

REPLACEMENT COVER AND TEXT (1 PAGE)- APPENDIX A OF RA WORK PLAN (INTRODUCTION TO SAP)

SAMPLING AND ANALYSIS PLAN
REMOVAL ACTION FOR PCB TSCA WASTE
BUILDING 3
ST. LOUIS ARMY AMMUNITION PLANT
ST. LOUIS, MISSOURI
(Revision 1)

PRE-PLACED REMEDIAL ACTION CONTRACT
CONTRACT NO. DACW41-00-D0019
TASK ORDER NO. 0002

Submitted to:

Department of the Army
U.S. Army Engineer District,
Kansas City Corps of Engineers
700 Federal Building
601 East 12th Street
Kansas City, Missouri 64106

Department of the Army
Aviation and Missile Command
Building 3206 Redstone Arsenal
Huntsville, Alabama 35898

Submitted by:

Arrowhead Contracting, Inc.
12920 Metcalf Avenue, Suite 150
Overland Park, Kansas 66213

November 8, 2001

Sampling and Analysis Plan

This document constitutes a Sampling and Analysis Plan (SAP) for a Removal Action of Polychlorinated Biphenyl (PCB) Toxic Substances Control Act (TSCA) in Building 3 at the Saint Louis Army Ammunition Plant (SLAAP) located at 4800 Goodfellow Boulevard in Saint Louis, Missouri.

The proposed Removal Action at Building 3 targets PCB contamination in concrete, soil, and waste that is present at concentrations that are at or above 50 parts per million (ppm). The data and information that will be generated from the sampling activities will support the implementation of activities planned in the Removal Action Work Plan (RAWP).

This document was prepared on behalf of the U. S. Army Corps of Engineers (USACE), Kansas City District (CENWK) and the U.S. Army Aviation and Missile Command (AMCOM), Huntsville, Alabama under the Arrowhead Contracting, Incorporated (Arrowhead) Pre-Placed Remedial Action Contract (PRAC) number DACW41-00-D0019, Task Order 0002. This SAP consists of two parts:

Part I – Field Sampling Plan (FSP)
Part II – Quality Assurance Project Plan (QAPP)

The FSP provides the data quality objectives for the proposed sampling and a description of the procedures and protocols to be followed during the implementation of the proposed sampling activities. The QAPP provides the quality assurance/quality control guidelines for the collection and analysis of all environmental samples.

This document has been prepared in accordance with the provisions of USACE Engineering Manual (EM) 200-1-3.

REPLACEMENT TEXT-
PART 1 OF APPENDIX A
(FSP)

Part I - Field Sampling Plan

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List of Acronyms

ACI	Arrowhead Contracting, Inc.
AMCOM	Aviation and Missile Command
ATCOM	Army Aviation and Troop Command
ATSDR	Agency for Toxic Substances and Disease Registry
AVSCOM	Aviation Systems Command
CENWK	U.S. Army Corps of Engineers, Kansas City District
CENWO	U.S. Army Corps of Engineers, Omaha District
CAR	corrective action request
COC	chain-of-custody
CQAB	U.S. Army Corps of Engineers, Chemistry Quality Assurance Branch of the Waterway Experiments Station Environmental Laboratory
DQCR	Daily Quality Control Reports
DFW	definable feature of work
DoD	U.S. Department of Defense
DQO	data quality objective
EBS	Environmental Baseline Study
EM	Engineering Manual
EPA	U.S. Environmental Protection Agency
FWV	Field Work Variance
FSP	Field Sampling Plan
H_0	null hypothesis
ID	inner diameter
IDW	investigation derived waste
kg	kilogram
mg/kg	milligram(s) per kilogram
µg/l	microgram(s) per liter
mg/l	milligram(s) per liter
mm	millimeter
NCR	Nonconformance Report
NON	Notice-of-Noncompliance
OSHA	Occupation Safety and Health Association
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PRAC	Pre-Placed Remedial Action Contract

List of Acronyms (continued)

QAPP	Quality Assurance Project Plan
QC	quality control
QCP	Quality Control Plan
QMP	Quality Management Plan
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
SAP	Sampling and Analysis Plan
SHERP	Safety, Health, and Emergency Response Plan
SLAAP	St. Louis Army Ammunition Plant
SLOP	St. Louis Ordnance Plant
sq. ft.	square feet
SVOCs	semi-volatile organic compounds
TCLP	Toxicity Characteristic Leaching Potential
TSCA	Toxic Substances Control Act
USACE	U.S. Army Corps of Engineers

1.0 Introduction

The purpose of this Field Sampling Plan (FSP) is to establish the sampling strategy, sample locations, and the procedures and protocols to be followed during a sampling effort in support of a Removal Action for polychlorinated biphenyl (PCB) contamination in Building 3 at the Saint Louis Army Ammunition Plant (SLAAP), Saint Louis, Missouri (refer to Figure 1-1). The sampling activities were developed based on the scope of the Removal Action as defined in this Removal Action Work Plan for PCB Toxic Substances Control Act (TSCA) Waste, Building 3, Saint Louis Army Ammunition Plant (SLAAP), St. Louis, Missouri (Arrowhead, 2001) and the findings regarding the nature and extent of PCB contamination presented in the Field Investigation Report for Determination of PCB TSCA Quantities, Building 3, SLAAP, St. Louis, Missouri (Arrowhead, 2001).

This document has been organized into eleven sections. The contents of each section are discussed below.

- Section 1.0 - Introduction

- Section 2.0 – Project Organization and Responsibilities
  - Identifies organizations, roles, and responsibilities for key personnel to be used during field activities.

- Section 3.0 – Sampling Program Rationale
  - Presents a sampling strategy based on the data quality objective (DQO) process.

- Section 4.0 – Field Activities
  - This section presents a description of the field activities, the rationale for conducting the activities, the field protocols to be used during the activities, and laboratory analysis for the planned field sampling activities.

- Section 5.0 – Sample Chain-of-Custody/Documentation
  - Presents details regarding sample documentation including field logbooks, sample labels, sample collection field sheets and chain-of-custody.

- Section 6.0 – Sample Packaging, Shipping, and Archiving
  - Presents details regarding sample packaging, shipping and archiving.

- Section 7.0 – Investigation Derived Wastes

- Presents details regarding handling, storage, and disposal of investigation derived waste.

- Section 8.0 – Contractor Quality Control
  - Presents details regarding contractor quality control.

- Section 9.0 – Field Corrective Actions
  - Presents a discussion of corrective actions for any non-conformances identified in the field.

- Section 10.0 – Project Schedule

- Section 11.0 – References
  - Presents references that are relevant to the basis of this FSP.

2.0 Project Organization and Responsibilities

Off-site analytical services will be provided by a USACE-certified analytical laboratory selected by means of a competitive procurement process. The USACE laboratory located in Omaha, Nebraska will analyze quality Assurance (QA) split samples. The organizations, roles, and responsibilities for key personnel to be used during the Removal Action at Building 3 are discussed in Section 1.2 of the Removal Action Work Plan.

3.0 Sampling Program Rationale

The sampling strategy described in this FSP is based on the Data Quality Objective (DQO) process presented in *EPA Soil Screening Guidance: Technical Background Document* (EPA, 1996). Based on this guidance, a sampling strategy has been developed and organized consistent with the steps of the DQO process:

- State the problem
- Identify the decision
- Identify inputs to the decision
- Define the study boundaries
- Develop a decision rule
- Specify limits on decision errors
- Optimize the design for obtaining data

Each of these steps is discussed below.

3.1 Data Quality Objectives Process

3.1.1 State the Problem

The primary objective of the sampling program is to collect sufficient data to define the area and volume of PCB contamination at concentrations of 43.5 ppm (action level) or greater that may be present in concrete, soil, sediment, and waste in Building 3. These data will be used to determine the quantities of materials that will be removed from Building 3 as part of the Removal Action. Secondary objectives for the Removal Action include the profiling of removal action waste to be shipped off-site for disposal.

3.1.2 Identify the Decision

The decision to remove or not remove concrete, soil, cast iron sewer piping, and waste in Building 3 as part of the proposed remedial action will be based on whether PCB concentrations in these materials exceed an action level of 43.5 ppm. If so, the materials will be addressed as part of the Removal Action. Decisions related to determining proper disposal of liquid waste generated as a result of the Removal Action will be contingent upon results of PCB and metals analyses.

3.1.3 Identify Inputs to the Decision

This step in the DQO process requires identifying the inputs to the decision process, including the basis for sampling and the applicable chemical analyses. The inputs for deciding whether to collect particular samples and to perform specific chemical analyses are based on activities to be conducted as part of the Removal Action as described in the Removal Action Work Plan.

Sampling to determine PCB TSCA waste quantities will include:

- Confirmation samples at the lateral and vertical limits of planned excavations of soil from the basement (including vertical limits of the excavation in the former Chip Chute Area) and lateral limits of concrete to be removed from the basement
- Discrete samples of concrete flooring on the first and second floors at selected locations where data gaps were identified in the Field Investigation Report.
- Discrete samples of sediment from cast iron sewer pipes in the basement.

The matrix spike/matrix spike duplicate (MS/MSD) samples collected during the Field Investigation to Determine TSCA PCB Quantities were spiked with a concentration of 50 ppm Aroclor 1248 (the most common type of PCB found during initial sampling). The minimum effective recovery of the PCB contaminant from the concrete matrix was 43.5 ppm (87 percent recovery). Therefore, the action level for removal of concrete, soil, and waste will be set at 43.5 ppm to insure that concrete that may contain PCB contamination above 50 ppm is disposed of in an appropriate manner.

Sampling will be conducted on liquid waste generated from decontamination and concrete saw cutting activities conducted as part of the Removal Action. The determination of proper waste disposal methods will be based on regulatory limits established for metals and PCBs.

3.1.4 Define the Study Boundaries

This step in the DQO process defines the sample media of interest (areas and depths of concern), subdivides areas of concern into manageable units, and specifies temporal or practical constraints on the data collection.

3.1.4.1 Media of Interest

The media of interest include concrete, soil, and sediment that may contain PCB contamination at concentrations that are equal to or greater than 43.5 ppm. The media of interest will also include liquid waste (liquids generated from the decontamination processes and concrete saw cutting) that will be generated from the Removal Action activities.

3.1.4.2 Areas of Concern

Table 3-1 identifies the Areas of Concern that will be investigated. The limits of the Areas of Concern in the basement and on the first and second floors of the building were developed based on the information shown in Figures 3-1, 3-2, and 3-3, respectively, and correspond to areas where PCBs were detected at concentrations greater than 43.5 ppm during the Field Investigation to Determine TSCA Waste Quantities, as well as sanitary sewer pipes in the basement that are suspected of containing PCB contaminated sediment.

The second type of concern is the liquid waste generated from the concrete saw cutting operation in known areas of PCB contamination and from the equipment decontamination processes.

3.1.4.3 Constraints on Data Collection

The sampling will be confined to areas where PCB contamination is suspected of being present at concentrations of 43.5 ppm or greater. This target concentration has been selected to support removal of materials that will be disposed at a TSCA facility.

Sampling for determination of proper disposal methods will be confined to liquid waste generated from the concrete saw cutting in known areas of PCB contamination and from the equipment decontamination processes.

3.1.5 Develop a Decision Rule

The following decision rules have been adopted for this FSP:

- *If the concentration of total PCBs exceeds the action level (as defined in Section 3.1.6) in a selected area (i.e., quadrant or sector of concrete flooring on the first and second* *floors, concrete flooring in the basement, soil in the basement, and concrete columns in the basement) or in cast iron sewer piping in the basement, then the materials associated with that area or piping will be subject to removal and disposal at a TSCA facility.*

- *If metals and PCB concentration in liquid waste meet acceptable discharge limits, the waste will be discharged to a POTW. If not, the liquid will be shipped to a facility capable of treating and disposing of the waste.*

3.1.6 Evaluate Decision Errors and Optimize the Design

The PCB sampling data will be used to support a decision about whether materials will be removed and disposed at a TSCA facility. Because of variability in contaminant concentrations within an area, practical constraints on sample sizes, and sampling or measurement error, the data collected may be inaccurate or non-representative and may mislead the decision makers into making an incorrect decision. A decision error occurs when sampling data mislead decision makers into choosing a course of action that is different from or less desirable than the course of action that would have been chosen with perfect information.

The EPA guidance, *Verification of PCB Spill Cleanup by Sampling and Analysis* (EPA, 1985), recognizes that data obtained from sampling and analysis are never perfectly representative and accurate, and that the costs of trying to achieve near-perfect results can outweigh the benefits. Consequently, uncertainty in data must be tolerated to some degree. The DQO process controls the degree to which uncertainty in data affects the outcomes of decisions that are based on those data. This step of the DQO process allows the decision maker to set limits on the probabilities of making an incorrect decision.

The DQO process utilizes hypothesis tests to control decision errors. When performing a hypothesis test, a presumed or baseline condition, referred to as the "null hypothesis (H_0)", is established. This baseline condition is presumed to be true unless the data conclusively demonstrate otherwise, which is called "rejecting the null hypothesis" in favor of an alternative hypothesis.

When the hypothesis test is performed, two possible decision errors may occur:

1. Decide not to remediate an area (i.e., "walk away") when the correct decision (with complete and perfect information) would be to "remediate"

2. Decide to remediate when the correct decision would be to "walk away."

Based on observation made during the Field Investigation to Determine TSCA Waste Quantities, further sampling should be structured to guard against false negative, i.e., failure to detect the presence of PCB levels above the allowable limit. To minimize the likelihood of false negatives, the action level has been set at 43.5 ppm. The action level was established based on MS/MSD recoveries observed during the Field Investigation to Determine TSCA Waste Quantities. In addition, potential PCB contamination in areas of concrete flooring on the first and second floors will be evaluated on a quadrant-specific basis (100 $ft^{2)}$. Confirmation samples will be collected at the following locations to determine final limits of soil and concrete removal and concrete decontamination:

- Sidewalls and base of planned soil excavations.
- Adjacent to areas planned for concrete floor removal in the basement.
- Soil beneath concrete flooring to be removed in the basement.
- Columns to be decontaminated in the basement.

3.2 Sample Collection Summary

This section introduces the basic program for sampling. The specific procedures associated with the sampling are discussed in Section 4.0. Table 3-2 presents a summary of the PCB sampling methods for each area of concern.

Discrete samples of the concrete flooring for PCBs will be collected using coring methods to the depths specified in Table 3-3. A core sample will be collected at the center of 19 quadrants on the first floor as identified in Figure 3-2. Core samples will be collected at the center of 5 quadrants on the second floor as identified in Figure 3-3. The concrete core samples will be collected in accordance with procedures detailed in Section 4.1.

Discrete samples of sediment from all 20 runs of cast iron sewer pipes in the basement will be collected to determine whether the piping will be disposed of as TSCA waste. The location of the piping is shown on Figure 3-5 of the Removal Action Work Plan. The procedures for collection of the sediment samples are detailed in Section 4.1.

Following removal or decontamination of designated materials in the basement, confirmatory samples will be collected to verify that PCB concentrations in the remaining concrete flooring, soil, and concrete columns are below the action level. The confirmation-sampling program will consist of the following elements:

- Confirmation samples will be collected from the sidewalls and the base of the areas designated for soil removal.
- Confirmation samples will be collected from the concrete flooring located adjacent to areas planned for concrete floor removal in the basement. Confirmation samples will also be collected from the soil located beneath the concrete flooring to be removed.
- Confirmation samples will be collected from the concrete columns after decontamination has been completed.
- Confirmation samples will be collected from the base of the excavation planned in the former Chip Chute Area.

Procedures associated with the confirmation sampling are outlined in Section 4.1. The locations of concrete and soil removal and column decontamination in the basement are shown on Figure 3-1.

Samples will be collected of containerized liquid waste generated from the concrete saw cutting and equipment decontamination activities to determine proper methods for disposal. The sample collection procedures for this activity are detailed in Section 4.1.

4.0 Field Sampling Activities

Section 4.0 presents a description of the field sampling activities and protocols to be implemented during the sampling effort at Building 3. The activities discussed in this section include sample layout, sampling, and equipment decontamination.

A project-specific Safety, Health and Emergency Response Plan (SHERP) has been prepared for the Removal Action. Topics presented in the SHERP including, among other things, potential hazards associated with field activities at Building 3, recommended hazard control measures, monitoring, and requirements for personal protective equipment (PPE). Personnel involved with the field activities described in this FSP shall comply with provisions in the SHERP. Due to the expected generation of dust during field activities in the basement, Level C PPE (including half-face respirators with HEPA filters) is anticipated for certain aspects of the fieldwork. However, PPE requirements may be adjusted based on actual field conditions and results of monitoring activities (refer to the SHERP).

4.1 PCB Sampling

PCB sampling will include concrete floor sampling, confirmation soil sampling, sediment sampling from sewer pipes, and confirmation concrete column sampling.

4.1.1 Sample Preparation Area

A sample processing production line will be arranged in the former garage and paint booth areas of Building 3. This area will consist of three primary stations:

- Concrete saw – MK tilesaw, cooling water bath, 55-gallon drum for decontamination water and cooling fluids
- Concrete pulverizer – BICO pulverizing unit, 55-gallon drum for decontamination water
- Sample weighing and packaging area

4.1.2 Concrete Floor Samples

Figure 3-1 identifies the proposed locations for concrete floor samples in the basement. Figures 3-2 and 3-3 depict the locations the discrete concrete core samples to be collected on the first and second floors.

Concrete samples will be collected from the center of each quadrant identified in the green areas shown on Figures 3-2 and 3-3. By convention, the quadrant locations will be identified as A, B, C, and D (refer to Figure 4-1). Concrete floor samples from the basement will be collected at a frequency of one sample every 20 feet along the perimeter of the concrete flooring surrounding the area to be removed (refer to Figure 3-1).

A concrete cap covers the majority of the first and second floors of Building 3. The cap was installed in 1992 following a remediation effort that involved scabbling the floors. As a means of penetrating the cap to sample the original flooring, concrete floor samples will be collected using coring machines. The coring process provides a continuous core sample that facilitates the identification of the interface between the cap and original floor. A sample will be collected from the upper one inch (0- 1 in.) of the original concrete flooring. Concrete floor samples on the first and second floors of the building will be collected as follows:

- At each sample location the concrete floor will be cored to a maximum of 5 inches below the concrete cap using a Milwaukee coring machine with 2-inch inner diameter core sampler. The depth of five inches below the cap was chosen as the optimum coring depth (for a cap thickness of 4 inches) during initial sampling. This depth ensured that the core penetrated deep enough below the original floor surface to obtain the required depth intervals for sampling. The coring depth will be decreased where the cap is believed to be less than 4 inches in thickness.

- Using a MK tilesaw, each concrete core aliquot will be cut at the interface between the original flooring and the concrete cap and 1 inch below the concrete cap.

- The core sample will then be pulverized using a BICO VP 1989 vibratory pulverizer. The concrete core section will be placed into a steel grinding bowl along with a steel disc and steel ring. A steel lid will be placed on the grinding bowl. The grinding bowl will then be placed into a fixture inside the pulverizing unit. Once the grinding bowl is secured in place and the top cabinet door of the pulverizing unit is closed, the pulverizer will be operated for a 30 second cycle. The cycle time is controlled by an automatic, digital timer. During the cycle, the bowl is vibrated/shaken at high speed. The concrete core will be mechanically pulverized by the steel disc and ring as the bowl is vibrated/shaken. This process reduces the concrete core sample to a powdered material of approximately 400 mesh.

- The pulverized material will then be poured/scraped from the grinding bowl into a 4-ounce glass jar. The jar will be labeled with the appropriate sample ID number.

- The sample jar will then be placed on ice to maintain the temperature at 4 C prior to being packaged and shipped to the laboratory.

- Sampling equipment (coring bit, saw blade, grinding bowl, grinding accessories) will be decontaminated between each sample.

Confirmation samples will be collected at seven (7) locations along the perimeter of the areas to be removed in the basement to determine whether additional concrete removal is warranted. The samples will be collected every 20 feet along the perimeter and one-foot outside the edge of the areas where the concrete will be removed. Concrete confirmation samples from the basement floor will be collected with as follows:

- Using a drill with a concrete bit, a hole will be drilled to a depth of 1 inch.

- A sufficient number of holes will be drilled (to a depth of approximately one-inch) to produce the required sample mass (approximately 20 grams)

- The powdered material generated during the drilling process will be collected and placed directly into a 4-oz glass jar. The jar will be labeled with the appropriate sample ID number.

- The sample jar will then be placed on ice to maintain the temperature at 4 C prior to being packaged and shipped to the laboratory.

- Sampling equipment (drill bit) will be decontaminated between each sample.

4.1.3 Confirmation Soil Sampling Beneath Basement Concrete Floor

Confirmation samples will be collected from the soil located beneath areas where concrete will be removed in the basement. The samples will be collected from the upper six inches of soil located below the interface of the gravel/sand base material and the soil. Twenty-seven (27) sampling locations have been identified, one sample per sector (400 ft^2) of concrete flooring identified as having PCB contamination above 43.5 ppm (refer to Figure 3-1).

Soil confirmation samples from beneath the concrete floor will be collected with as follows:

- Using a stainless-steel bucket hand auger or small barrel drive sampler, advance the boring to a depth of 6 inches. Gravel base, if present, will be cleared away prior to advancing the boring.

- Placed the soil into a stainless steel mixing bowl and mix thoroughly to homogenize the material.

- Place approximately 30 grams of soil directly into a 4-oz glass jar. The jar will be labeled with the appropriate sample ID number.

- The sample jar will then be placed on ice to maintain the temperature at 4 C prior to being packaged and shipped to the laboratory.

- Sampling equipment (auger and drive barrel sampler, mixing bowl, and mixing spoon) will be decontaminated between each sample.

4.1.4 Confirmation Concrete Column Sampling

Six (6) confirmatory samples will be collected at the location concrete columns to be decontaminated in the basement (refer to Figure 3-1). The samples will be collected after the column has been decontaminated as detailed below:

- Using a drill with a concrete bit, a hole will be drilled to a depth of 1 inch at a location near the center of the decontaminated area.

- A sufficient number of holes will be drilled (to a depth of approximately one-inch) to produce the required sample mass (approximately 20 grams)

- The powdered material generated during the drilling process will be collected and placed directly into a 4-oz glass jar. The jar will be labeled with the appropriate sample ID number.

- The sample jar will then be placed on ice to maintain the temperature at 4 C prior to being packaged and shipped to the laboratory.

- Sampling equipment (drill bit) will be decontaminated between each sample.

4.1.5 Confirmation Soil Sampling

Once soil has been excavated, confirmation samples will be collected from the excavation base and sidewalls and submitted to an off-site laboratory for PCB analysis. Confirmation samples will be collected at three locations with Area A and two locations at the base of Areas B, C, D, and E. The confirmation samples will be distributed evenly over the base of each area. Confirmation samples that be collected from the sidewalls of Area A will be distributed every 20 feet along the excavation perimeter. Confirmation samples to be collected from sidewalls in Areas B, C, D, and E will be collected at four locations distributed evenly along the perimeter of the excavation. Based on the approach outlined above, it is estimated that 35 confirmation samples will be collected in all of the areas. Areas planned for soil excavation are shown on Figure 3-1. Soil samples will be collected as follows:

- Using a stainless-steel bucket hand auger or small barrel drive sampler, advance the boring to a depth of 6 inches below the soil excavation. The samples from the sidewalls will be collected with a spoon.

- Placed the soil from the excavation base into a stainless steel mixing bowl and mix thoroughly to homogenize the material. Soil from the sidewalls will be placed directly into a sample jar.

- Place approximately 30 grams of soil into a 4-oz glass jar. The jar will be labeled with the appropriate sample ID number.

- The sample jar will then be placed on ice to maintain the temperature at 4 C prior to being packaged and shipped to the laboratory.

- Sampling equipment (auger and drive barrel sampler, mixing bowl, and mixing spoon) will be decontaminated between each sample.

4.1.6 Sediment Sampling

Sediment suspected of being in cast iron sewer piping in the basement will be sampled for PCBs. One sediment sample will be collected from all 20 runs of piping as shown on Figure 3-5 of the Work Plan. The samples will be collected as follows:

- A section of piping will be opened near the end of the pipe run to determine if sediment is present within the piping. If sediment is not present, then a second section of piping will be accessed near the middle of the pipe run. If sediment is not present at the second location, then the piping will be declared to be free of TSCA waste.

- Collect approximately 20 grams of sediment from the piping using a plastic disposable spoon and place into a 4-oz glass jar. The jar will be labeled with the appropriate sample ID number.

- The sample jar will then be placed on ice to maintain the temperature at 4 C prior to being packaged and shipped to the laboratory.

4.1.7 Soil Sampling in Chip Chute Area

Two confirmation soil samples will be collected from the excavation in the former Chip Chute Area. The samples will be collected from the upper six (6) inches of soil at the base of the excavation. Soil samples will be collected as follows:

- Using a stainless-steel bucket hand auger or small barrel drive sampler, advance the boring to a depth of 6 inches below the soil excavation.
- Placed the soil from the excavation base into a stainless steel mixing bowl and mix thoroughly to homogenize the material.
- Place approximately 30 grams of soil into a 4-oz glass jar. The jar will be labeled with the appropriate sample ID number.
- The sample jar will then be placed on ice to maintain the temperature at 4 C prior to being packaged and shipped to the laboratory.
- Sampling equipment (auger and drive barrel sampler, mixing bowl, and mixing spoon) will be decontaminated between each sample.

4.2 Removal Action-Derived Waste (RADW) Sampling

Liquid waste generated during the Removal Action will include cooling water from concrete coring operations, concrete cutting operation, decontamination of sampling equipment and the concrete columns, and from the decontamination of sample processing equipment (tilesaw, grinding bowls, etc). All Removal Action-derived waste (RADW) will be containerized in steel, open-top or closed-top 55-gallon drums. Cooling water and decontamination water will be combined in the field for convenience. Drums of RADW will be placed in the drum storage area, which will consist of polyethylene-lined flooring surrounded by a continuous absorbent boom for secondary containment.

RADW will be sampled to assess the options for disposal. Rather than sample the RADW for a full-range of analytes and tests, the analytes will be selected based on knowledge of the processes that generated the wastes. Constituents reasonably anticipated to be present in the RADW include PCBs and metals.

RADW water samples will be collected using the following procedures:

- Collect composite sample of drums containing liquids from similar type of operation (i.e., decontamination of columns, decontamination of equipment, concrete saw cutting of floor). The samples will be collected with the use of a Teflon bailer.

- Place approximately one liter of liquids into an amber glass jar for PCB analysis. Place approximately 500 ml of liquids into plastic container for metals analysis. Plastic container will be preserved with nitric acid. Approximately 30 grams of soil will be placed into a 4-oz glass jar.

- Label the sample jars with the appropriate sample I.D. number.

- The sample jar will then be placed on ice to maintain the temperature at 4 C prior to being packaged and shipped to the laboratory.

- Sampling equipment (Teflon bailer) will be decontaminated between each sample.

4.3 Field Documentation and Quality Control

The primary means of field documentation will include sample collection field sheets and the Daily Quality Control Report (DQCR). Sample collection field sheets will be completed by sampling technicians for each sample. Information recorded on the field sheets will include, sample IDs, QA/QC sample IDs (if applicable), time and date of sample collection, sample collection methods, name(s) of sample technician(s), sample depth intervals, types of sample containers, and analytical parameters and methods. As necessary, diagrams and other pertinent notes will be included on the sample collection field sheets. Additionally, the QA/QC Manager or Site Supervisor will complete a DQCR that summarized the day's field activities. The DQCR will include the number and types of samples collected, preliminary PCB analytical results (if available), a list of equipment on site, health and safety activities, and other significant findings or events.

The QA/QC Manager and/or Site Supervisor will complete daily QC inspections. The QC inspections will document on activity-specific (i.e. composite floor sampling, soil sampling) QC checklists. The QC inspections are designed to ensure that field activities are performed in accordance with project specifications (FSP and QAPP) and accepted field practices. Inspection items included, among other things, the proper location of samples, use of specified equipment and methods, proper decontamination procedures, use of the required sample containers, and proper sample packaging and chain-of-custody protocols. The QA/QC Manager will also maintain a log of samples collected. This log serves as means for tracking samples to ensure that QA/QC samples are collected at the proper frequencies. Furthermore, the QA/QC Manager also records pertinent information in a field logbook; however, field sheets and the DQCR act as the primary source for field documentation and QC.

4.4 Health and Safety

Health and safety activities for the investigation will be performed in general accordance with the SHERP included as Appendix B of the Removal Action Work Plan. The Site Safety and Health Officer (SSHO) will conduct a tailgate safety meeting for all field personnel at the beginning of each day. During the meeting, the major health and safety issues associated with the planned fieldwork are discussed. Typical issues discussed during these meetings include heat stress, slips/trips/falls, noise hazards, machinery point-of-operation hazards, dust generation, and carbon monoxide (CO) emissions from generators.

Requirements for dust, air, and asbestos monitoring (including asbestos clearance sampling) and for personal protective equipment (PPE) are discussed in the SHERP.

The SSHO will perform a daily inspection of safety equipment and procedures. These inspections will be documented via a safety checklist, which is attached to the DQCR. Field equipment will be inspected each day by the SSHO to check for proper maintenance and safe operation, including the presence of safety guards. A checklist will be completed for each machine to document the inspection. Other documentation related to health and safety includes: daily safety meeting record, daily hot work permit for generators, SHERP compliance agreement forms, and training verification forms.

5.0 Sample Chain-of-Custody and Documentation

During sampling activities, the samples must be traced from the time the samples are collected until laboratory data are issued and samples appropriately disposed. Initial information concerning collection of the samples will be recorded on the sample collection data sheet. Information regarding the transfer, handling, and shipping of all samples will be recorded on a Chain-of-Custody (COC) (refer to Appendix A).

The sample custodian will be responsible for initiating and filling out the COC. The sampling team members are responsible for the care and custody of the samples collected until the samples are transferred to another individual or shipped to the analytical laboratory. The sampling team, under the direction of the Field Supervisor, is responsible for enforcing COC procedures during fieldwork. When samples are relinquished the sample custodian will sign the COC with date and time. The COC will accompany the samples at all times. All individuals who subsequently take possession of the samples will also sign, with date and time, the COC.

Each cooler containing samples sent to the analytical laboratory will be accompanied by the COC. Laboratory personnel are responsible for the receipt and entry of samples into the laboratory database. This tracking system will document the sample from the moment that the laboratory takes custody of the sample until the sample is properly disposed.

5.1 Field Logbook

Field logbooks will be maintained to record all pertinent information. Entries will be as descriptive and detailed as possible so that a particular situation can be reconstructed without reliance on the collector's memory. Field logbooks (which will consist of a 5 x 7 1/2-inch bound book with consecutively numbered pages) will be kept by a field representative.

The cover of each field logbook will contain the following information:

- Project name and number
- Book number
- Activity type
- Start date
- Stop date

Entries to a field logbook will be made daily and, at a minimum, will consist of the following:

- Date
- Start time
- Weather
- All field personnel present
- Visitors to the site (time, name, and company)
- Level of personnel protection used
- Type of activity conducted
- Sampling location
- Sample identification number
- Description of sampling point
- Method of sampling
- Type of sample
- Air monitoring readings, if applicable
- Pertinent field observations
- Field measurements, if applicable
- Description of all related activities
- Signature of the person making the entry.

All entries will be made in indelible ink. No erasing of entries will be permitted. If an incorrect entry is made, the data shall be crossed out with a single strike mark and initialed. Entries will be organized into easily understandable tables, if possible.

Field documentation requirements associated with site health and safety is presented in the SHERP.

5.2 Photographs

Color digital photographs will be taken prior to, during, and after conducting field activities. Photographs will be tracked with a numbered photograph log that will include the project name, date, and description of activity or location (e.g., core sampling, and soil sampling).

5.3 Sample Numbering System

Each type of sample collected during the investigation will be identified by a two to four character prefix as follows:

- CF1 – concrete floor sample, first floor
- CF2 – concrete floor sample, second floor
- CFB – concrete floor sample, basement
- RADW– removal action derived waste sample
- SS – soil sample
- PS – pipe sediment sample
- CC – concrete column sample

In the basement and on the first and second floors of the building, the building column in the northwest corner of the sector will be used to identify the sample location. For example, "D24" represents a sample location in the 20 ft x 20 ft sector where the building column in the northwest corner is located in Row D, Column 24. Accordingly, sample IDs for concrete floor samples consisted of the prefix "CF1" or "CF2" follow the sector ID. For example, "CF1D24" indicates the location of the concrete floor sample on the first floor in Sector D24. The aliquots from each sector are designated with the letters A, B, C, or D depending on which quadrant the aliquot sample is collected from. For example, "CF1D24A" indicated the aliquot sample from quadrant A of Sector D24. By convention, quadrant "A" is the northwest quadrant within the sector. The remaining quadrants, "B", "C", and "D", will be designated in counter clockwise fashion from quadrant "A".

Concrete samples collected from the basement will begin with "CFB" and be followed by an identifier from the section from which it was collected. For example "CFBC13" indicates a concrete sample collected from the basement in Sector C13.

RADW sample IDs will consist of the prefix "RADW" followed by a unique two digit identifier for each respective sample. Soil sample IDs will consist of the prefix "SS" followed by a unique two digit identifier for each respective sample.

For field duplicates, the sample identification number will have a "500" added to make it unrecognizable to the subcontract laboratory. For example, sample identification CF1-D12 would be CF1-D512 if it were a field duplicate. For sample splits to the USACE quality assurance laboratory, the sample identification will have a "D" added as a suffix. For example, CF1-D12 would be CF1-D12-D if it were a split sample.

For rinsates, the sample identification number will have a "R" added as a suffix to the sample identification number of the sample collected prior to the rinsate. For example, CF1-D12-R would be a rinsate collected immediately after the concrete floor sample CF1-D12.

5.4 Equipment Decontamination

Sampling equipment and sample processing equipment will be decontaminated between each sample location. The decontamination procedure includes the following steps:

- Washing and scrubbing with Alconox soap and water
- Application of analytical grade heptane
- Final rinse with deionized water

Decontamination fluids will be containerized in 55-gallon drums and managed as RADW as described in Section 4.2.

5.5 Sample Documentation

Sample documentation will be conducted in accordance with the following subsections.

5.5.1 Sample Labels

Each sample collected for chemical analysis, or archived for possible future analysis, will be placed in the appropriate container(s) and labeled at the time of sample collection with the following information:

- Arrowhead project number and name
- Sample number
- Date and time of collection
- Required analyses and methods
- Matrix sampled
- Type of preservative, if applicable
- Volume of sample and container type
- The name of the sampler
- Initials of the sampler and date.

5.5.2 Sample Collection Field Sheets

An example of a Sample Collection Field Sheet used to document pertinent information associated with the various samples is presented Appendix A.

5.5.3 Chain of Custody Procedure

The COC procedures are as follows:

- At the time of sample collection, the COC is completed for the sample collected.

- The sample custodian will cross-check the form for possible errors. Corrections will be made to the record with a single strike mark and dated and initialed. All entries will be made in blue or black ink. The COC will be signed when the samples are relinquished.

- A shipping bill will be completed and the shipping bill number recorded on the COC prior to enclosing inside a clear plastic bag and attaching it to the inside of the cooler lid.

When transferring custody of the samples, the individual relinquishing custody of the samples will verify sample numbers and condition and will document the sample acquisition and transfer by signing, with date and time, the COC. The sample custodian will group samples for shipment to the analytical laboratory and complete a COC for each cooler of samples. Samples will be packaged for shipment and dispatched to the analytical laboratory with a COC accompanying each cooler.

Custody seals will be used to ensure that sample shipping containers have not been opened during shipment and prior to receipt at the off-site laboratory. The following information will be included on the custody seals:

- Signature of the sample custodian
- Date when the sample package is sealed

All seals will be completed using indelible ink. The seals will be affixed to the front and back of the cooler, at the interface of the cooler and the lid. The placement of the seals will be in a manner that breaking the seals would be necessary in order to open the sample cooler.

In conjunction with data reporting, the analytical laboratory will return the original or a photocopy of the original COC to the Contractor for inclusion into the project file.

All samples collected will remain in the possession of the sample custodian until shipment. Secured areas will be used for interim storage if necessary. If coolers (used for sample storage) must be left unattended for extended periods of time, signed custody seals will be placed on the front and back of each cooler or the cooler will be stored under lock until shipped to the off-site laboratory.

When the analytical laboratory receives the sample coolers, a sample receipt form will be completed. The laboratory will document the sample condition upon receipt. All receipt nonconformance situations will be reported immediately to the Field Supervisor.

5.5.4 COC Documentation

A copy of each COC will be retained by the sample custodian for the project file, and the original sent with the samples. For sample packages sent by carrier to a laboratory off-site, shipping receipts will be retained as part of the documentation for the COC records.

6.0 Sample Packaging and Shipping

This section describes packaging and shipping procedures for collecting environmental samples. Samples will be shipped off-site according to applicable guidance documents and U.S. Department of Transportation (DOT) regulations. To minimize sample container breakage and provide adequate sample temperature during shipment, sample containers will be prepared and packaged according to the following procedures:

- Secure sample bottle lids (Note: Teflon cap liners will be used for all samples submitted for PCB analysis). The sample label will be securely attached by placing clear tape over the label.

- Place custody tape over the sample container lid or cap.

- Place sample bottles in Styrofoam sleeves (if provided); or place sample bottles in "Zip-lock" clear plastic bags and wrap them with protective packing material.

- Tape the drain hole shut on the inside and outside of a waterproof metal (or equivalent strength plastic) cooler.

- Line the sides and floor of the cooler with protective packing material.

- Line the cooler with a large plastic bag.

- Place containers upright in the cooler in such a way that they do not touch.

- Packing material will be placed in appropriate locations to minimize potential container breakage during shipment. Care will be taken so that the packing material does not thermally insulate the containers from the ice placed in the shipping container.

- Pack the area surrounding the samples with ice (either chemical ice packs or ice cubes sealed in plastic bags).

- Fill the remaining space in the cooler with cushioning material.

- Close the large plastic bag in the cooler and tape or secure shut.

- Place the completed COC and other paperwork in a sealed, clear plastic bag and tape the bag to the inside lid of the cooler. (Note: The original COC will accompany the shipment, and copies will be retained by the sampler for return to project management and the project file).

- Wrap the cooler completely around with strapping tape at two locations. Do not cover any labels.

- Place the address label of the shipment destination on top of cooler.

- Affix signed custody seals on the cooler at the interface between the cooler and the lid, both in the front and the backside. Cover the seals with wide, clear tape.

- Make a copy of the shipping bill for the project file and place the original in a clear envelope secured to the outside of the cooler lid.

Samples will be sent to an off-site laboratory by use of an overnight courier delivery service. Prior to shipment of samples, arrangements will be made with the laboratory to receive and analyze the samples. All samples will be submitted with results returned to Arrowhead within 7 days of sample submittal.

Laboratory specific receiving and handling procedures will be described in the Laboratory Quality Assurance Plans.

Key personnel contacts are provided below:

ANALYTICAL LABORATORY
To be determined (TBD)

CENWK
U.S. Army Corps of Engineers
ATTN: CENWK-PM-ED (Brad Eaton, P.E.)
Technical Manager
700 Federal Building, 6th Floor
601 E. 12th Street
Kansas City, MO 64106
(816) 983-3368

U.S. Army Corps of Engineers
ATTN: CENWK-EP-ED (Kurt Baer)
Project Engineer
700 Federal Building, 6th Floor
601 E. 12th Street
Kansas City, MO 64106
(816) 983-3392

U.S. Army Corps of Engineers
ATTN: CENWK-EC-DC (Francis Zigmund)
Project Chemist
700 Federal Building, 6th Floor
601 E. 12th Street
Kansas City, MO 64106
(816) 983-3905

CQAB
Ms. Laura Percifield
420 South 18th Street

Omaha, NE 68102
(402) 444-4314

ARROWHEAD

Greg Wallace, Project Manager/Field Supervisor
12920 Metcalf, Suite 150
Overland Park, Kansas 66213
(913) 814-9994
(913) 461-3828 (cell phone)

Scott Siegwald, SHSO and QC Inspector
12920 Metcalf, Suite 150
Overland Park, Kansas 66213
(913) 814-9994
(913) 461-3804 (cell phone)

7.0 Removal Action-Derived Waste Management

RADW generated during sampling activities will include decontamination (rinse) water, concrete from concrete sampling, and PPE. General procedures for managing RADW are as follows:

- Decontamination fluids and fluids generated during sampling activities will be containerized in a holding tank or in 55-gallon drums. Containerized decontamination fluids will be labeled and inventoried. Labels shall, at a minimum, define the contents, the date the RADW was collected, and the reason for containerization. An up-to-date container inventory will be maintained on site that documents the type of container, the contents of the container, date of arrival at storage area, and the container status (e.g., awaiting analytical results). In addition, routine visual inspections of the storage area will be made to identify areas of potential leaks or spills. At the conclusion of the field sampling activities, samples of the containerized fluids will be submitted to the analytical laboratory for analysis of PCBs and Total Metals as discussed below.

- Unused portions of concrete from concrete samples and miscellaneous concrete cuttings will be placed back into the core holes from which they were collected.

- Personnel protective clothing will be placed in plastic trash bags and disposed as municipal waste.

Waste minimization will involve the following objectives:

- Minimize volume by cleaning, compacting, drying, and decanting
- Separate soil waste media from water waste
- Plan not to mix contaminant in containers; segregate wastes by contaminants
- Clean contaminated PPE if possible and dispose as solid municipal waste
- Use waste minimization as a design criteria and for planning for design life cycles, per U.S. Department of Defense (DoD) directives
- When possible, budget final waste disposal costs within each activity budget and each activity schedule to avoid accumulating waste.

Decontamination fluids will be sampled via an access port at the top of the drum or holding tank using a decontaminated bottle sampler. The sample will be transferred to the appropriate sample containers (refer to Section 5.0 of the QAPP). A Sample Collection Field Sheet (refer to Appendix A) will be completed and the following information recorded in a field logbook:

- Date/time of sampling
- Sampling team personnel
- Sample number
- Quantity of decontamination fluid in container
- Location of container sampled
- Other data as required.

Samples of decontamination fluids will be packaged and shipped to the designated analytical laboratory as discussed in Section 6.0 this FSP. Final disposition of the drummed wastewaters will be determined based on the results of the laboratory analysis.

8.0 Contractor Quality Control

This section provides the criteria for the performance of inspections of each Definable Feature of Work (DFW) associated with the field activities. Inspections are the processes whereby the Quality Control (QC) Inspector, by examination or measurement, determines that an activity complies with the specified quality requirements. The inspection system is based on the USACE three-phase system of control to cover the activities. The three-phase inspection system consists of preparatory, initial, and follow-up inspections for applicable DFWs.

8.1 Definable Features of Work

A DFW is defined as a major work element that must be performed in order to execute and complete the project. It consists of an activity or task that is separate and distinct from other activities and requires separate control activities. The following DFWs have been identified for the planned field activities:

- Layout
- Concrete Floor Sampling
- Concrete Column Sampling
- Soil Sampling
- Investigation Derived Waste Sampling

A detailed inspection checklist for each of these DFWs is included in Appendix A.

8.2 QC Inspections

The QC Inspector will coordinate inspection activities with the Project Manager/Field Supervisor, subcontractors, and field personnel. Inspection activities will be performed on a periodic basis.

8.2.1 Preparatory Inspections

Preparatory inspections will be performed prior to the initiation of all DFWs. The preparatory inspection is performed in advance of any work being performed to enable all involved parties to determine if equipment and supplies are properly in place and ready to initiate the work activity. This inspection will be conducted by the QC Inspector and will be attended by field personnel and subcontractors. The preparatory inspection will be scheduled prior to the start of the DFW. All affected parties will be notified in advance of the inspection to coordinate their participation. The preparatory inspection will include, but is not limited to:

- Review of pertinent contract requirements and plans
- Review of required control inspections and test requirements
- Review of reports, forms, and checklists that need to be filled out during the activity
- Review of subcontracts and purchase orders
- Review of required licenses, permits, and utility notifications
- Establish that required planning documents have been reviewed and approved by USACE and regulators
- Establish that the required materials and equipment for commencement of the DFW are on-hand or available and are in accordance with plans and calibration requirements
- Establish that the preliminary work required to begin the DFW is complete and conforms to approved plans
- Schedule the date that the initial inspection, if required, will be performed
- Review and discuss the SHERP requirements for the DFW.

For analytical activities, the QC Inspector will contact the laboratory to insure they are ready to begin accepting samples and to review any questions regarding the requirements of the QAPP or the subcontract.

8.2.2 Initial Inspections

Initial inspections will be conducted at the initiation of a DFW. The initial inspection will provide the opportunity for the QC Inspector to observe the actual initiation of the work activity and the individual segments of the DFW. The inspection will be performed on a representative sample of work to evaluate the following criteria:

- Compliance with the plans and other contract requirements
- Acceptable levels of workmanship
- Identify use of defective or damaged materials
- Identify improper procedures or methods
- Acceptable test or inspection results
- Compliance with the SHERP.

8.2.3 Daily QC Inspections

Daily QC inspections of field activities will be performed on a daily basis when work on a DFW is in progress. The Daily QC inspections will be performed until all work on a DFW is completed. The following items will be performed during the Daily QC inspection:

- Verify compliance with the plans and other contract requirements
- Verify level of workmanship, if applicable
- Verify test or inspection results
- Verify nonconformance issues are identified, corrected, and re-inspected
- Verify compliance with the SHERP.

8.2.4 Documentation

The preparatory, initial, and follow-up inspections will be documented on forms. Example Preparatory, Initial and Daily QC Inspection Checklist are provided in Appendix A. The Daily QC Inspection Checklist will be attached to the Daily Quality Control Report (DQCR) and submitted to the USACE on a weekly basis during performance of the activity. If a final inspection for either a specific task or the entire project is required, this information will be provided on the Final Inspection Form presented Appendix A.

If the inspection process identifies a nonconforming condition, it will be documented, tracked, and corrected. Non-conformance Reports (NCR) and Corrective Action Requests (CARs) will also be attached to the Daily Quality Control Report.

8.3 Daily Quality Control Reports

DQCRs will be prepared to document field activities performed. Quality control personnel will prepare DQCRs with input from the Field Supervisor, sampling personnel, and others conducting the field activities. The DQCRs will contain the following information pertaining to the field sampling activities:

- Weather information at the time of sampling
- Sample collection field sheets
- Copies of field logbooks
- Copies of COC forms
- Field instrument calibration forms
- Field instrument measurements
- Verbal instructions received from CENWK or AMCOM personnel
- Problems encountered during sampling
- Field Work Variances
- Forms included in this SAP.

Attachments to the DQCR will include:

- Daily QC Inspection Checklist
- CAR, if necessary
- NCR, if necessary
- Daily Chemical Data Report (refer to Section 15.0 of the QAPP)

9.0 Field Corrective Actions

Corrective actions will be implemented by the Contractor or its subcontractors to correct nonconformance issues identified during QC inspections or during the course of conducting activities. A nonconformance is defined as a deficiency in implementation of a procedure or standard that renders the quality of an item or activity unacceptable or indeterminate with respect to the acceptability criteria. Correction of nonconformance issues will be focused at determining the cause of the deficiency and instituting actions to correct the deficiency and prevent recurrence.

Corrective actions will be implemented and documented via a CAR. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are deemed insufficient, work may be stopped through a stop-work order issued by the Contractor Project Manager and/or the CENWK Project Manager

9.1 Nonconformance Reporting

Noncompliance with specified criteria will be documented through a formal nonconformance control and corrective action program. Personnel who identify a nonconformance are responsible for notifying the Contractor Project Manger of the nonconformance. The Contractor Project Manager will discuss the nonconformance with USACE on-site representative to determine if the nonconformance has been properly described and that applicable project requirements or criteria have not been met to warrant issuance of a NCR (refer to Appendix A). The Contractor Project Manager will immediately notify the CENWK PM of any major or critical deficiencies (i.e., deficiencies requiring re-sampling, re-analysis of samples, or re-drilling/coring) identified during the course of project execution.

9.2 Nonconformance Disposition and Tracking

Corrective actions required to bring nonconforming conditions into compliance will be approved by the Contractor Project Manager prior to implementation. Corrective actions will be documented in a field CAR, which will be attached to DQCR. NCRs will remain on open status and tracked until the corrective actions have been implemented and verified acceptable by the Contractor Project Manager. If appropriate, the Contractor Project Manager will ensure that no dditional work associated with the nonconforming activity is performed until the corrective actions are completed. This will be implemented through a stop-work order issued by the Contractor Project Manager.

9.3 Field Work Variances

Changes to approved plans or procedures may be required when events occur or presumed information must be altered based on actual conditions encountered during the course of field activities. Request for approval to vary from approved plans, specifications or procedures will be submitted to the CENWK with a Field Work Variance (FWV) (refer to Appendix A). Minor variances can be implemented in the field prior to receipt of written approval of the FWV when approved by the USACE on-site representative. Minor variances are defined as those variances that do not affect project cost, schedule, quality or quantities. Major variances require written approval prior to implementation. Major variances impact cost, schedule, quality, and quantities and vary from the approved plans, specifications, or procedures. FWVs will be submitted to the USACE COR for approval. All changes as a result of FWVs will be documented in a final report.

10.0 Project Schedule

The procurement of Subcontractors, equipment, and supplies will begin approximately 4 weeks prior to fieldwork. Fieldwork is tentatively scheduled to begin on November 12, 2001. The estimated time to completion for fieldwork is 12 weeks. The final results of chemical analysis will be completed approximately 2 weeks after the field sampling is completed. It is anticipated that the results of this investigation will be summarized in a Removal Action Report. A draft version of the report will be submitted approximately one month after the Removal Action is completed.

Task/Deliverable	*Scheduled Date of Completion/Date of Submittal*
Field Sampling Activities	November 12, 2001 through February 21, 2002
Final Laboratory Results Received	14 days following end of field sampling activities
Draft Removal Action Report	March 19, 2001
Final Data Report	May 7, 2001

11.0 References

Arrowhead Contracting, Inc. (Arrowhead). 2001. *Alternatives Evaluation for Removal of PCBs, Saint Louis Army Ammunition Plant, St. Louis, Missouri.* December.

Arrowhead Contracting, Inc. (Arrowhead). 2001. *Field Investigation Report, Determination of PCB TSCA Waste Quantities, Saint Louis Army Ammunition Plant, St. Louis, Missouri.* November.

Tetra Tech EM, Inc. (Tetra Tech). 2000. *Final Environmental Baseline Survey Report, Saint Louis Army Ammunition Plant, St. Louis, Missouri.* December.

United States Environmental Protection Agency (EPA). 1985. *Verification of PCB Spill Cleanup by Sampling and Analysis.* August.

United States Environmental Protection Agency (EPA). 1996. *Soil Screening Guidance: Technical Background Document.* May.

REPLACEMENT FORMS - APPENDIX A OF THE FSP (PART 1 OF THE SAP)

Arrowhead Contracting, Inc.

Sheet ____ of ____

Inspection Checklist - Concrete Floor Sampling

Location:	Date:	Photograph? If yes, photograph number.
	Time:	___ Yes ________ Number ___ No
Inspection Type (circle one): Initial	Daily QC	

Task	Yes	No	NA	Remarks
Are checklist items identified during the preparatory inspection being addressed?				
Are coring locations being measured in reference to existing features (columns, walls, etc.)?				
Is proper PPE in use?				
Is coring equipment being decontaminated between each use?				
Are fresh gloves being used to handle each sample?				
Are concrete cores being collected from each quadrant, and to a final depth of 5 inches below the concrete cap/original floor interface ?				-
Is the concrete saw being decontaminated between each use?				
Are the concrete cores from each quadrant being cut into samples from 0"-1" below the concrete cap/original floor interface?				
Is the drill and sampling collection equipment being decontaminated between each use?				
Is the electronic balance been reset to zero (tared) before use?				
Is twenty (20) grams of sample from each quadrant and depth interval being collected for PCB analysis?				
Are the sample containers for the respective sector and depth being labeled properly?				
Is the remaining sample volume been retained in a separate container and labeled appropriately?				
Have the individual 5-gram aliquot samples from each quadrant and depth in each sector been adequately composited within the sample container for PCB analysis?				
Are the composited samples being placed on ice?				
Has the chain-of-custody been completed for the samples?				
Has a sample collection field sheet been completed for each sample?				
Is all non-disposable equipment being decontaminated before each use?				
Has all IDW been properly contained?				
Did samplers record pertinent sampling information in the field log book?				
Were labels properly filled out (with sample ID, date, time, analyses, and preservative) and attached to all sample containers?				
Were samples properly packaged and custody tape placed on the shipping container?				
Were required QA/QC samples (duplicates, MS/MSD, rinsates) collected, packaged, and shipped to the laboratory along with the primary samples?				
Were QA/QC samples labeled to distinguish them from the corresponding primary sample?				
Were required split samples collected, packaged, and shipped to the USACE laboratory?				
Was the laboratory contacted the next day to confirm that the samples arrived at the laboratory in satisfactory condition?				

Notes:

Arrowhead Contracting, Inc.

Sheet ____ of ____

Inspection Checklist - Discrete Soil Sampling

Location:	**Date:** **Time:**	Photograph? If yes, photograph number.
Inspection Type (circle one): **Initial** **Daily QC**		___ Yes _________ Number ___ No

Task	Yes	No	NA	Remarks
Are checklist items identified during the preparatory inspection being addressed?				
Have utilities been cleared for the sampling locations?				
Are sampling locations being measured in reference to existing features (columns, walls, etc.)?				
Is proper PPE in use?				
Is sampling equipment being decontaminated between each use?				
Are fresh gloves being used to handle each sample?				
Are soil samples being collected from 0 to 6 inches below grade?				
Is the material from each horizon being thoroughly homogenized?				
Are the proper type and number of sample containers being filled with soil material?				
Are the sample containers being labeled properly?				
Is the remaining sample volume been placed back into the borehole?				
Are the samples being placed on ice?				
Has the chain-of-custody been completed for the samples?				
Has a sample collection field sheet been completed for each sample?				
Is all non-disposable equipment being decontaminated before each use?				
Has all IDW been properly contained?				
Did samplers record pertinent sampling information in the field log book?				
Were labels properly filled out (with sample ID, date, time, analyses, and preservative) and attached to all sample containers?				
Were samples properly packaged and custody tape placed on the shipping container?				
Were required QA/QC samples (duplicates, MS/MSD, rinsates) collected, packaged, and shipped to the laboratory along with the primary samples?				
Were QA/QC samples labeled to distinguish them from the corresponding primary sample?				
Were required split samples collected, packaged, and shipped to the USACE laboratory?				
Was the laboratory contacted the next day to confirm that the samples arrived at the laboratory in satisfactory condition?				

Arrowhead Contracting, Inc.

Sheet ___ of ___

Inspection Checklist - Discrete Concrete Column and Wall Sampling

Location:	Date:	Photograph? If yes, photograph number.
	Time:	___ Yes _________ Number
Inspection Type (circle one): Initial Daily QC		___ No

Task	Yes	No	NA	Remarks
Are all checklist items identified during the preparatory inspection being addressed?				
Are coring locations being measured in reference to existing features (columns, walls, etc.)?				
Is proper PPE in use?				
Is drilling and sample collection equipment being decontaminated between each use?				
Are fresh gloves being used to handle each sample?				
Are concrete samples being drilled to a final depth of 1 inch ?				
Is the electronic balance been reset to zero (tared) before each use?				
Is at least a twenty (20) gram sample being obtained for PCB analysis?				
Is the remaining sample volume being retained in a separate container and labeled appropriately?				
Are the samples placed on ice?				
Has the chain-of-custody been completed for the samples?				
Has a sample collection field sheet been completed for each sample?				
Is all non-disposable equipment being decontaminated between each use?				
Has all IDW been properly contained?				
Did samplers record pertinent sampling information in the field log book?				
Were labels properly filled out (with sample ID, date, time, analyses, and preservative) and attached to all sample containers?				
Were samples properly packaged and custody tape placed on the shipping container?				
Were required QA/QC samples (duplicates, MS/MSD, rinsates) collected, packaged, and shipped to the laboratory along with the primary samples?				
Were QA/QC samples labeled to distinguish them from the corresponding primary sample?				
Were required split samples collected, packaged, and shipped to the USACE laboratory?				
Was the laboratory contacted the next day to confirm that the samples arrived at the laboratory in satisfactory condition?				

Notes:

ARROWHEAD CONTRACTING, INC.	**Contract No:** DACW41-00-D0019 Task Order 0002
Definable Feature of Work: **Location:** St. Louis Army Ammunition Plant	**Inspection Date:** **Specification:** Sampling & Analysis Plan

Requirements/Reference	**Yes**	**No**	N/A	**Remarks**
Preparatory Inspection				
1. Have field personnel reviewed the Sampling and Analysis Plan (SAP) and associated procedures?				
2. Are project forms (i.e. DQCRs, NCRs, FWVs, COCs, sample collection field sheets) available?				
3. Has a project kick-off meeting occurred?				
4. Have necessary utility clearances been obtained?				
5. Has a source of electrical power been established for field equipment?				
6. Has a filing system for project evidence files been established?				
7. Has a sample staging/packaging area been established?				
8. Has a subcontract been set-up with an approved laboratory for off-site analytical activities?				
9. Has the analytical laboratory been notified of the start of sampling activities?				
10. Have sample containers (jars and bottles) been received in good condition? Do sample containers contain the proper preservatives?				
11. Have sample packaging supplies (i.e. plastic bags, coolers, tape) been received?				
12. Have sampling personnel been trained on the sample numbering system?				
13. Has PPE been received in good condition?				
14. Has concrete coring, sawing, and drilling equipment been received in good condition and checked for operation?				
15. Is sampling equipment in good condition and clean?				
16. Have containers for RADW management been received in good condition?				

	Contract No: DACW41-00-D0019 Task Order 0002
Definable Feature of Work: **Location:** St. Louis Army Ammunition Plant	**Inspection Date:** **Specification:** Sampling & Analysis Plan

Requirements/Reference	Yes	No	N/A	Remarks
Preparatory Inspection				
17. Has deionized water, Alconox, and methanol for equipment decontamination been received?				
18. Have decontamination and IDW disposal procedures been reviewed with field personnel?				

Arrowhead Contracting, Inc. QA/QC Representative ______________________________

Date: ________________

REPLACEMENT TEXT - PART 2 OF APPENDIX A (QAPP)

Part II – Quality Assurance Project Plan

Table of Contents

List of Tables

List of Acronyms

AA	atomic absorption
ASTM	American Society for Testing and Materials
CENWK	Kansas City District Office of the U.S. Army Corps of Engineers Northwest Division
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	chain-of-custody
DQCR	Daily Quality Control Report
DQI	data quality indicator
DQO	data quality objective
DRO	diesel range organics
ECD	electron capture detector
ELCD	electrolytic conductivity detector
EPA	Environmental Protection Agency
FADL	Field Activity Daily Log
FSP	Field Sampling Plan
FWV	Field Work Variance
g	gram
GC	gas chromatography
GC/ECD	gas chromatography/electron capture device
GRO	gasoline range organics
HNO_3	nitric acid
HPLC	high-performance liquid chromatography
HTRW	Hazardous, Toxic, and Radioactive Waste
ICP	inductively coupled plasma
ICPAES	Inductively Coupled Plasma Atomic Emission Spectroscopy
LCS	laboratory control sample
LIMS	Laboratory Information Management System
LOR	Letter-of-Receipt
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
NCR	Nonconformance Report

List of Acronyms (continued)

NIST	National Institute of Standards and Technology
ppm	parts per million
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCSR	Quality Control Summary Report
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SLAAP	St. Louis Army Ammunition Plant
SOP	standard operating procedure
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristic Leachate Procedure
TPP	technical project planning
USACE	U.S. Army Corps of Engineers
XRD	X-ray diffraction
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter

1.0 Introduction

This portion (Part II) of the Sampling and Analysis Plan (SAP) consists of the Quality Assurance Project Plan (QAPP). The QAPP will be used to guide analytical and quality assurance/quality control (QA/QC) activities during field work at Building 3 at the Saint Louis Army Ammunition Plant (SLAAP) (refer to Figure 1-1 of the FSP for the location of SLAAP). The United States Army Corps of Engineers (USACE) and the United States Environmental Protection Agency (EPA) require participation in a centrally managed quality assurance (QA) program for environmental monitoring efforts. Any party generating data for an environmental monitoring project has the responsibility to implement procedures to ensure that the data is of adequate quality (in terms of precision, accuracy, representativeness, and completeness) and that the data is appropriately documented. To ensure these responsibilities are met, parities involved in the project must adhere to the requirements specified in this QAPP.

The Field Sampling Plan (FSP) portion (Part I) of this SAP contains detailed descriptions of, among other things, project scope and objectives, planned sampling activities, sampling rationale, number of samples, and sampling methods. This QAPP (Part II of the SAP) presents a detailed discussion of the analytical and QA/QC activities associated with the Building 3 sampling effort, including data quality objectives, analytical methods, field QA/QC sampling, laboratory QC checks, laboratory calibration procedures, and data validation and reporting. Despite covering different aspects of the project, the contents of each plan are not mutually exclusive. It is intended that the QAPP and FSP be used jointly for purposes of project management.

It should be noted that analytical activities and methodologies associated with analysis of QA split samples to be performed by USACE at a USACE-designated laboratory are not addressed within this document. This QAPP applies to Contractor analytical requirements only. However, the collection of the QA split samples by the Contractor is addressed herein.

The QAPP has been organized into sixteen sections. The contents of each section are summarized below:

- Section 1.0 – Introduction
  - Discusses the general purpose and rationale for development of the QAPP and the relationship of the QAPP to the FSP.

- Section 2.0 – Project Organization and Responsibilities
  - Presents the project organization and responsibilities as they relate to analytical services.

- Section 3.0 – Data Quality Objectives
  - Presents, in general terms, the data quality design process and selection of quality objectives for project data.

- Section 4.0 – Sampling and Analysis Program
  - Presents the type of samples to be collected and the corresponding analyses to be performed.

- Section 5.0 – Sample Containers, Preservation, and Holding Times
  - Presents the requirements for sample containers, preservation, and holding times.

- Section 6.0 – Field QA/QC Samples
  - Presents the types QA/QC samples to be collected during the project, including the frequency of collection.

- Section 7.0 – Analytical Methods
  - Presents a general description of the analytical methods and sample preparation procedures.

- Section 8.0 – Laboratory Calibration Procedures
  - Presents the general procedures for maintaining the accuracy of instruments and equipment used for conducting laboratory analyses.

- Section 9.0 – Laboratory QA/QC Checks
  - Presents details regarding the types of QA/QC samples that will be analyzed to check the performance of the laboratory.

- Section 10.0 – Laboratory Preventative Maintenance
  - Presents a general description of preventative maintenance associated with laboratory instruments and equipment.

- Section 11.0 – Analytical Corrective Actions
  - Presents the corrective actions that will be implemented in the event problems are encountered with analytical equipment or data quality criteria.

- Section 12.0 – Calculation of Data Quality Indicators
  - Presents general descriptions of the methods for assessing project data relative to data quality indicators, including accuracy, precision, completeness and comparability.

- Section 13.0 – Data Reduction, Validation, and Reporting
  - Presents a description of the overall data review process to ensure the validity and usability of project data.

- Section 14.0 – Performance and System Audits
  - Presents a description of the audits that will be conducted to ensure that analytical and QA/QC activities are conducted in accordance with the QAPP.

- Section 15.0 – Quality Assurance Reports to Management
  - Presents details regarding the various types of quality assurance reports that will be prepared and submitted to management during the project.

- Section 16.0 – References
  - Presents a list of references associated with this QAPP.

All QA/QC procedures will be in accordance with applicable professional technical standards, EPA and USACE requirements, government regulations and guidelines, and specific project goals and requirements. This following are the primary references used for the development of this QAPP:

- *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA 1991)
- *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA 1994a)
- *Chemical Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities* (USACE 1998)
- *Requirements for the Preparation of Sampling Analysis Plans* (USACE 1994a).

2.0 Analytical Organization and Responsibilities

The general project organization and responsibilities are presented in Chapter 2.0 of the FSP. The table lists the CENWK, Contractor, and subcontractor positions that have responsibility for obtaining analytical data for the project. The information presented in this section, provides the organization and responsibilities of the Contractor environmental laboratory(ies) that will provide analytical services under the contract.

Analytical laboratory support specific to the Building 3 sampling effort will be obtained from USACE certified laboratory.

Organization charts outlining the key laboratory personnel and organization will be identified in the QA Plans submitted by the laboratory. The responsibilities of key personnel will also be described in the QA plan. Key analytical personnel include:

- Quality Assurance/Quality Control Manager
- Project Manager
- Laboratory Manager
- Laboratory Technicians and Sample Custodians
- Data Manager

Note: Prior to commencement of field activities for the project, the Contractor will provide a complete copy of the SAP to the laboratory.

3.0 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements derived from the DQO process that specify, from an end users perspective, the quality of data required to support decisions made during investigative activities. The DQOs specify the maximum level of uncertainty the user is willing to accept in order to accurately make project decisions. DQOs are developed prior to data collection and should be specified for all data collection activities that take place.

3.1 Project Objectives

The underlying objective with respect to data quality is to generate data that is technically sound and legally defensible. In terms of the Building 3 sampling effort, the specific objectives are to:

- Identify areas and quantities of contamination in Building 3 that will be addressed in the Removal Action.
- Characterize Removal Action-derived waste (RADW) (concrete saw cutting liquid and decontamination water) generated during the Removal Action to determine proper disposal methods.

This is to be accomplished through the proper implementation of the field sampling procedures, chain of custody (COC) documentation, controlled laboratory analysis, and validation of the reported data prior to their use. The necessary procedures for field sampling and COC are discussed in the FSP. Procedures for laboratory analysis and data validation are discussed in other sections of this QAPP.

3.2 Data Quality Design Process

As described in the USACE Engineering Manual, EM 200-1-2, *Technical Project Planning (TPP) Process* (USACE 1998), the data quality design process is basically a four-phase process performed to identify the data needed to support specific project decisions and to create a data collection program to collect the necessary data. The DQOs generated as a result of the TPP process are project-specific statements that incorporate nine data quality requirements:

1. Project objective(s) satisfied
2. Data user perspective(s) satisfied

3. Contaminant or characteristic of interest identified
4. Media of interest identified
5. Required sampling areas or locations and depths identified
6. Number of samples required
7. Reference concentration of interest or other performance criteria identified
8. Sampling method identified
9. Analytical method identified

Most of these requirements are addressed in Section 3.0 of the FSP. The remaining requirements are addressed in this QAPP. A general summary of the DQO design process for the Building 3 project is presented in Table 3-1.

3.2.1 Identify Current Project Strategy

The first phase of the TPP process brings together decision-makers and technical personnel (e.g., customer, data users, and regulators) to identify an overall strategy to manage a site from its current condition to the desired closeout condition. Integral to development of a strategy for the site is establishing both short- and long-term objectives for the project. These objectives are the driver for collecting data. The overall strategy for the Building 3 project is discussed in detail in the FSP. Project objectives are presented in Section 3.1.

3.2.2 Determine Data Needs

Following establishment of the project strategy and objectives, data needs are identified commensurate with the expectations of the end-users of the data, such that the level of data quality will satisfy all project objectives. During this phase, technical personnel evaluate existing data, if any, and define the media-type, chemical requirements and numbers of samples necessary to statistically support the data users decision-making process. Considerations include:

- Data needed to satisfy project objectives
- Data user
- Intended use of data
- Number of samples necessary to satisfy intended use
- Reference concentration of analyte of interest
- Area of interest or desired sampling location(s) and depth(s).

The data needs for the Building 3 project, including the areas of interest (concern), sampling locations, sample depths, and types and number of samples, is presented in Section 3.0 of the

FSP (referencing Tables 3-1 through 3-4). Table 3-1 of the QAPP summarizes the data needs and presents the analytes of interest for the project.

3.2.3 Develop Data Collection Options

The next phase of the TPP is to design and plan the sampling and analysis activities necessary to fulfill the data needs. During this phase, the collection options are developed. Technical personnel document the requirements for data collection options, including the appropriate sampling and analysis methods. The documentation process must include:

- Data needs being met
- Project objectives to be satisfied
- Number of samples are to be collected
- Locations from where the samples are to be collected
- Sample collection methods to be used
- Sample analysis methods to be used
- List limitations, benefits or requirements associated with each data collection option.

This phase of the DQO design process was discussed in detail in Sections 3.0 and 4.0 of the FSP.

3.2.4 Finalize Data Collection Program

This final phase is to create a data collection program that best fits the short-term and long-term objectives. The design of the data collection program is performed by the PM and data users and should include the regulators and stakeholders to ensure representation of all key data needs. The type and frequency of samples to be collected, as well as definition with respect to the data collection options will be identified during this phase. Additionally, project-oriented DQO statements are prepared that describe the intended data use(s), the data need requirements, and the means to achieve them. Table 3-1 presents the DQO statements for the Building 3 project. The overall sampling and analysis program resulting from the DQO design process is discussed in Section 4.0.

3.3 Quality Assurance Objectives for Analytical Data

The final step in establishing the DQOs is to determine the analytical data quality indicators (DQIs). The primary DQIs include precision, accuracy, completeness, sensitivity, representativeness, and comparability. The laboratory chosen to perform the analytical work will provide their laboratory quality assurance plan, which shall include the Standard Operating Procedures (SOPs) and laboratory-specific quality control limits for all contracted parameters. Based on the SOPs, the Contractor shall ensure that the laboratory is capable of complying with project-specific DQIs. A detailed discussion of the methods for calculating the primary DQI parameters is found in Section 12.0 of this QAPP. The DQI parameters are defined as follows:

- **Precision** – Precision is determined and reported as the relative percent difference (RPD) between the results for field duplicates and/or between the results for matrix spike/matrix spike duplicate (MS/MSD) samples. Data with acceptable quality shall meet the precision criteria presented in Tables 7-2 and 7-4.

- **Accuracy** – Accuracy is determined and reported as the percent recovery from the analysis of a reference material, MS/MSD, and /or laboratory control sample (LCS). Data with acceptable quality shall meet the accuracy criteria presented in Tables 7-2 and 7-4.

- **Completeness** – Completeness is determined for separate but integrated functions.
  - *Sample Collection Completeness* is calculated by comparing the number of samples actually collected in the field to the number of samples planned to be collected. Acceptance criteria for sample collection completeness shall be 95%.
  - *Acceptable Data Completeness* is defined as the percentage of useable data versus the total amount of data generated. Acceptable data are generated following a review (validation) of the data using the analytical method criteria (SW-846). Acceptable data are all data which have completed the review or validation process and have not been rejected. Acceptance criteria for acceptable data completeness shall be 95% for each analytical method defined in this QAPP.
  - *Quality Data Completeness* is defined as the percentage of quality data versus the total set of data. Quality data are analytical data obtained from a sample delivery group which meet all batch quality control criteria. Completeness criteria for quality data shall be 80%.

- **Sensitivity** is a quantitative reflection of the method detection limit (MDL). The reporting limit (RL) (also referred to as practical quantitation limit) is a secondary indicator of sensitivity. The MDLs and RLs are calculated by the analytical laboratory in accordance with 40 CFR Part 136 Appendix B. The RLs for the analytical methods to be used for this project are presented in Tables 7-1, 7-3, and 7-5. The subcontract laboratory shall submit SOPs identifying the MDLs for each analytical method.

- **Representativeness/Comparability** - Representativeness and comparability are both qualitative statements about the data which can provide quality data if the sampling set is adequately prepared and standard method of analysis are used for chemical analysis.

4.0 Sampling and Analysis Program

Based on the DQO design process discussed in Section 3.0, a project-specific sampling and analysis program was developed and is summarized in Table 4-1. The sampling effort performed at Building 3 will involve collection of samples for the following purposes consistent with the project objectives:

- Samples collected for PCB identification (quantity and volume estimates)
- Samples collected for RADW characterization

This sampling program will involve the collection of samples from the following media type:

- Concrete
- Soil
- IDW water and fiber samples

Areas of the Building 3 to be sampled are identified on Figures 3-1, 3-2, and 3-3 of the FSP. The rationale for the selection of these areas is discussed in detail in Section 3.0 of the FSP. Sampling methods are discussed in Section 4.0 of the FSP. Estimates of the number of samples to be collected by media type are presented in Tables 4-1 and 6-2. Additional portions of select samples will be collected to meet QA/QC requirements, including duplicates, QA split samples, and field blanks as discussed in Section 6.0. The collection frequencies for field QA/QC samples are presented in Table 6-1. Estimates of the number of QA/QC samples to be collected are presented in Table 6-2.

Samples will be analyzed for the following parameters:

- PCBs
- Total Metals (including Mercury)

The SW-846 methods that will be used to analyze samples for these parameters are presented in Table 4-1, and are discussed in further detail in Section 7.0. Sample container, sample volume, preservation and holding time requirements for the analytical parameters are discussed in Section 5.0 and presented in Tables 5-1 through 5-4.

5.0 Sample Containers, Preservation, and Holding Times

Sample containers, chemical preservation techniques, and holding times for concrete, soil, sediment, and water samples are presented in Tables 5-1 through 5-4. The specific number of containers will be estimated and supplied by the subcontracted analytical laboratory. When required by the analytical laboratory, additional sample volumes will be collected and provided for laboratory QC samples (laboratory duplicates, MS/MSD).

All sample containers will be provided by the analytical laboratory, which will also provide the required types and volumes of preservatives for the sample containers. Temperature preservation will be maintained at 4 C (±2 C) immediately after collection and will be maintained within this temperature range until the samples are analyzed. In the event that sample integrity, such as holding times, cooler temperatures, etc., is compromised, re-sampling will occur as directed by the CENWK Project Manager. Any affected data will be flagged and qualified per data validation instructions and guidance.

6.0 Field QA/QC Samples

Quality assurance/quality control (QA/QC) samples are analyzed for the purpose of assessing the quality of the sampling effort and of the reported analytical data. QA/QC samples to be used for the Building 3 project include field duplicates, USACE split samples, equipment rinsate blanks, and MS/MSD samples. Table 6-1 presents the frequencies at which the samples will be collected and analyzed. Table 6-2 presents the estimated numbers of QA/QC samples to be collected during the project.

6.1 Field Duplicates

Duplicates will be collected by the sampling team for analysis by the subcontractor laboratory. The purpose of these samples is to provide site-specific, field-originated information regarding the homogeneity of the sampled matrix and the consistency of the sampling effort. These samples are collected concurrently with the primary samples at the same time and location. Duplicate samples will be collected from each media type and submitted to the subcontractor laboratory for analysis. Duplicates will be collected at a frequency of 10% of the total planned field samples.

6.2 USACE Split Samples

Split samples will be collected by the sampling team and sent to a USACE QA laboratory for analysis. Split samples provide an independent assessment of the subcontractor laboratory performance. The Contractor will coordinate with the designated QA laboratory not less than 48 hours before sampling to ensure that the laboratory is alerted to receive the QA samples and process them within required holding times. Split samples will be collected from the same sample as the field duplicate at frequency of 10% of the total planned field samples.

6.3 MS/MSD Samples

MS and MSD project samples that are "spiked" by laboratory with known quantities of analytes. The spiked samples are then and subjected to the entire analytical procedure. The MS is used to verify the accuracy of the analytical method (for a particular matrix) by measuring percent recovery of the analyte. The MSD is used to assess the precision of the analytical method. To meet MS/MSD requirements, the laboratory typically needs additional volume of the sample collected in the field. If requested by the laboratory, MS/MSD samples will be collected at a frequency of 5% (one per 20) of the total planned field samples.

6.4 Equipment Rinsate Blanks

These samples will be taken from the water rinsate collected during equipment decontamination activities. Rinsate blank samples will consist of "clean" (analyte-free) water used as a final rinse of decontaminated sampling equipment. They will be collected and submitted for analysis of the parameters of interest. Equipment rinsate blanks are used to assess the effectiveness of the decontamination process, the potential for cross contamination between sampling locations, and incidental field contamination. Equipment rinsate blanks will be collected at a frequency of 5% (one per 20) of the total planned samples.

7.0 Analytical Methods

Samples will be analyzed by a subcontractor laboratory certified by the USACE Center of Expertise. QA samples shall be collected and analyzed by the designated USACE QA Laboratory.

The subcontractor laboratory supporting this work will provide statements of qualifications including organizational structure, QA Manual, and standard operating procedures (SOPs). Laboratory standard operating procedures are based on the methods as published by the EPA in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW846*, Third/Fourth Edition (November 1986; Revision 1, July 1992; Revision 2, November 1992; and Updates 1, 2, and 3). These SOPs must be adapted from and reference standard EPA SW-846 methods and thereby specify:

- Procedures for sample preparation
- Instrument start-up and performance check
- Procedures to establish the actual and required detection limits for each parameter
- Initial and continuing calibration check requirements
- Specific methods for each sample matrix type
- Required analyses and QC requirements

Samples collected during the project will be analyzed by EPA SW-846 methods. The analytes of interest and the corresponding SW-846 methods to be used for this project are presented in Table 3-1. The primary SW-846 methods include:

- Method 8082 – PCBs
- Method 6010B – Metals (except mercury)
- Method 7470A/74741A – Mercury

Tables 7-1 through 7-5 present the reporting limits and precision and accuracy limits for each of the primary analytical method. The subcontract laboratory shall submit SOPs detailing the specific MDLs for each analytical method.

If contaminant concentrations are high, or if matrices (other than normal waters and soils) create a problematic effect on the analysis, analytical protocols may require modifications to defined methodology. Any proposed changes to standard analytical methods require written approval from the Contractor and CENWK. All analytical method variations will be identified in project addenda. These may be submitted for regulatory review and approval when directed by the CENWK Project Manager.

7.1 Preparation Procedures

Extraction and digestion procedures for the preparation of solid and liquid matrices will include the following:

- **Method 3005A - Acid Digestion of Water Samples for Metals Analysis**: Method 3005A consists of an acid digestion procedure to prepare aqueous samples for metals analysis. The digested samples are analyzed for total recoverable and dissolved metals determination by inductively couple plasma spectroscopy (ICP).

- **Method 3010A - Acid Digestion of Aqueous Samples and Extracts for Metals Analysis**: Method 3010A prepares aqueous or waste samples for total metals determination by ICP.

- **Method 3540 <u>or</u> 3541 - Soxhlet Extraction**: The laboratory has the option of performing either Method 3540 or 3541 for sample extraction for PCB analysis.

7.2 Analytical Procedures

Analytical methods for solid and water matrices associated with this project will include:

- **Method 8082 – Polychlorinated Biphenyls (PCBs) by Gas Chromatography**: Method 8082 is used to determine the concentrations of PCBs as Aroclors or as individual PCB congeners in extracts from solid and aqueous matrices. Open-tubular, capillary columns are employed with electron capture detectors (ECD) or electrolytic conductivity detectors (ELCD).

- **Method 6010B - Trace Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy for Water and Soils**: Samples are analyzed for trace metals using Method 6010B for water and soils. Analysis for most metals requires digestion of the sample. Following digestion, the trace elements are determined simultaneously or sequentially using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPAES).

- **Method 7470A/7471A - Mercury Manual Cold-Vapor Technique**: Water and soil samples are analyzed for mercury using methods SW7470A and SW7471A, respectively. This method is a cold-vapor, flameless atomic absorption (AA) technique based on the absorption of radiation by mercury vapor.

8.0 Laboratory Calibration Procedures

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment that are used for conducting laboratory analyses. These instruments and equipment shall be calibrated before each use or on a scheduled, periodic basis according to manufacturer instructions.

8.1 Analytical Support Areas

The following sections discuss the calibration needs for operations within the analytical laboratory necessary to support the instrumentation.

8.1.1 Analytical Standards

All primary reference and secondary working standards used for the purpose of instrument calibration and recovery determinations must be traceable to National Institute of Standards and Technology (NIST) or EPA sources. The preparation and use of these standards must be documented in a logbook and will include the preparers' name, date of preparation, and date of expiration and storage location.

8.1.2 Laboratory Balances

All balances to be used for sample weights and/or standards preparation must receive an annual manufacturer's calibration. The balance must be calibrated daily with a minimum of two class "S" weights which bracket the range of weights to be determined. A hardbound balance logbook must be maintained with the results of the daily calibrations.

8.1.3 Laboratory Refrigerators/Freezers

All cold storage units (for both samples and standards) must be monitored daily for proper use. The acceptable working range of the unit must be clearly posted on the unit's front panel. All thermometers used for monitoring must be immersion type and be calibrated versus a certified thermometer on a yearly basis.

8.1.4 Laboratory Water Supply

The laboratory water unit shall be capable of supplying sufficient quantities of American Society for Testing and Materials (ASTM) Type II reagent water (resistivity of >1 megoh.n-cm @25 C) to the required analytical areas. Recommendations for "polishing" water for analytical use are ion-exchange units for inorganic analyses and distillation/deionization followed by UV treatment or carbon absorption for organic analyses. Conductivity or resistance reading of the system water shall be documented minimally daily or greater dependant upon the water usage.

8.2 Laboratory Analytical Instrumentation

Details regarding the procedures for calibration of laboratory equipment and maintenance of calibration records will be presented in laboratory QA Plans and/or SOPs. These procedures will be reviewed by the Contractor and USACE prior to the start of sampling and analysis activities. For all analyses conducted according to SW-846, the calibration procedures and frequencies specified in the SW-846 methods will be followed. Tables 8-1 through 8-3 present a summary of the standard calibration procedures for the project-specific analytical methods. Although these tables are provided for general reference, the subcontract laboratory shall submit SOPs and/or QA Plants detailing the specific calibration procedures (including acceptance criteria and corrective actions) to be used for each analytical method.

Records of calibration will be kept as follows:

- Each instrument will have a record of calibration with an assigned record number.
- A label will be affixed to each instrument showing identification numbers, manufacturer, model numbers, date of last calibration, signature of calibrating analyst, and due date of next calibration. Reports and compensation or correction figures will be maintained with instrument.
- A written step-wise calibration procedure will be available for each piece of test and measurement equipment.
- Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag to alert the analyst that the device carries only a "Limited Calibration."

Records of calibration, repairs, or replacement will be filed and maintained by laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit.

9.0 Laboratory QA/QC

The subcontractor laboratory will have a written QA program that provides guidelines to ensure the reliability and validity of work conducted at the laboratory. The objectives of the laboratory QA program will be to:

- Properly collect, preserve, and store all samples
- Maintain adequate custody records from sample collection through reporting and archiving of results
- Use properly trained analysts to analyze all samples by approved methods within holding times
- Produce defensible data with associated documentation to show that each system was calibrated and operating within precision and accuracy control limits
- Accurately calculate, check, report, and archive all data using the Laboratory Information Management System (LIMS)
- Document all the above activities so that project data can be independently validated.

Laboratory QA Plans will be appropriately referenced and implemented in their entirety. Compliance with the QA program will be coordinated and monitored by the laboratory's QA department, which is independent of the operating departments.

To ensure the production of analytical data of known and documented quality, the subcontractor laboratory will implement method and batch QC checks as described below. Internal quality control checks are generated by the analytical laboratory and are used to determine whether an analytical operation is in control or if the sample matrix has an effect on the data being generated. Internal QC measures for analysis will be conducted in accordance with SOPs and the individual method requirements. The minimum QC requirements for SW-846 methods (excluding 8015B) proposed for use at Building 3 are presented in Tables 8-1 through 8-3, including the types of QC checks, the frequency for implementation of each QC measure, and the acceptance criteria for the QC check. Although these tables are provided for general reference, the subcontract laboratory shall submit SOPs and/or QA Plants detailing the specific calibration procedures (including acceptance criteria and corrective actions) to be used for each analytical method.

The laboratory will provide documentation in each data package that both initial and ongoing instrument and analytical QC functions have been met. Any non-conforming analyses will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that sufficient sample volumes will be collected to provide for re-analyses, if required. Tables 8-1 through 8-3 present general QC acceptance criteria and corrective actions for the applicable analytical methods. However, the specific QC protocols used by the subcontractor laboratory will be documented in the Laboratory QA Plan and/or SOPs.

9.1 Batch Quality Control

Sample batch QC can either be associated with sample preparation or with the analytical determination. In either case, the batch is not to exceed twenty samples of similar matrix. The *preparation batch* is the set of samples, which are extracted or digested together by the same lab technician, with the same lot of reagents, over the same time. All the samples within the same preparation batch must be of the same matrix, and the batch must have its own unique method blank and QC samples as defined below. The *analytical batch* is the group of samples that are analyzed together during the same analytical sequence within one continuous time period. The analytical batch can consist of multiple preparation batches but must analyze all constituents of the preparation batch. QC cannot be run separate from the analytical samples.

9.1.1 Method Blanks

There are two types of method blanks –instrument blanks and preparation blanks. An instrument blank is an aliquot of pure, non-contaminated reagent (i.e. reagent water) that is analyzed prior to samples to establish background levels of the analytical system. The preparation blank is a sample of a pure, non-contaminated matrix of interest (usually reagent grade water or purified silica sand) that is subjected to all of the sample preparation (digestion, distillation, extraction) and analytical methodology applied to the samples. The preparation blank is used to assess the level of background contamination which might affect low level concentration results. The affect could be either false positive results or biased high concentration results. Method blanks must be prepared and analyzed with each analytical sample batch. Method blanks will be evaluated against MDLs in accordance with CLP National Functional Guidelines. Contamination levels reported in the blanks are never subtracted from the concentration of the sample.

9.1.2 Laboratory Control Samples (LCS)

The LCS contains known concentrations of analytes representative of the contaminants to be determined and is carried through the entire preparation and analysis process. The primary purpose of the LCS is to establish and monitor the laboratory's analytical performance control. Commercially available LCSs or those from EPA may be used. LCS standards prepared in-house must be made from a source independent of that of the calibration standards. An LCS must be analyzed with each analytical sample batch. The results (as percent recovery) for each LCS analyte must be plotted on a control chart.

9.1.3 Laboratory Duplicates

Laboratory duplicates are separate sample weights of a single sample that are prepared and analyzed concurrently at the laboratory. This duplicate sample shall not be a method blank, trip blank, or field blank. The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. If there are significant differences between the duplicates, the affected analytical results will be re-examined. One in 20 samples will be a laboratory duplicate, with fractions rounded to the next whole number.

9.1.4 Surrogate Spikes

A surrogate spike is prepared by adding a pure compound to a sample before extraction. The compound in the surrogate spike should be of a similar type to that being assayed in the sample. The purpose of a surrogate spike is to determine the efficiency of recovery of analytes in the sample preparation and analysis. The percent of recovery of the surrogate spike is then used to gauge the total accuracy of the analytical method for that sample. The frequency for performing surrogate spikes is dependent on the analytical method.

9.1.5 Matrix Spikes and Matrix Spike Duplicates

An MS is a second sample weight of the original sample spiked with known quantities of analytes and subjected to the entire analytical procedure. It is used to indicate the appropriateness of the method for the matrix by measuring recovery. An MSD is a second sample weight of the same sample with known quantities of compounds added. The purpose of the MSD is to evaluate method precision. MSs and MSDs are performed at a frequency of 5% (one per 20) of samples of similar matrix.

Note: For this project, MS/MSDs will be analyzed using sites-specific samples. For analysis of PCBs, the spiking concentration shall be 50 ppm.

9.2 Method-Specific Quality Control

The laboratory must follow specific quality processes as defined by the analytical method. These will include measures such as calibration verification samples, instrument blank analysis, internal standards implementation, method of standard additions utilization, serial dilution analysis, post-digestion spike analysis, etc.

10.0 Laboratory Preventative Maintenance

As part of the laboratory's QA/QC program, a routine preventive maintenance program will be implemented to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments will be maintained in accordance with manufacturers' specifications and the requirements of the specific method employed. This maintenance will be carried out on a regular, scheduled basis and will be documented in the laboratory instrument service log book for each instrument. Emergency repair or scheduled manufacturer's maintenance will be provided under a repair and maintenance contract with factory representatives. Table 10-1 of this QAPP provides typical maintenance items for select equipment associated with this project; however, this table is not intended to be inclusive of all required preventative maintenance procedures. The subcontractor laboratory shall provide written preventative maintenance in the laboratory-specific QA Plan and/or SOPs.

11.0 Analytical Corrective Actions

Corrective actions may be required for two major types of problems: analytical/equipment problems and noncompliance with acceptance criteria. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

The laboratory-specific QA Plan shall provide systematic procedures to identify laboratory related out-of-control situations and corrective actions. Corrective actions shall be implemented to resolve problems and restore malfunctioning analytical systems. Laboratory personnel will have received QA training and will be aware that corrective actions are necessary when:

- QC data are outside warning or control windows for precision and accuracy
- Blanks contain target analytes above acceptable levels and must be investigated
- Undesirable trends are detected in spike recoveries or RPD between duplicates
- There are unusual changes in detection limits
- Deficiencies are detected by internal audits, external audits, or from performance evaluation samples results
- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, prepares spike and calibration mixes, checks instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the Laboratory Supervisor, Manager, and/or QA Department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with project records and the QA Department, and the information is summarized within case narratives.

Typical analytical corrective actions include:

- Re-analyzing the samples, if holding time criteria permit
- Re-extraction and re-analysis, if holding time criteria permit
- Evaluating blank contaminant sources, elimination of these sources, and reanalysis
- Modifying the analytical method (i.e., standard additions) with appropriate notification and documentation
- Re-sampling and analyzing
- Evaluating and amending sampling procedures

- Accepting data and acknowledging the level of uncertainty.

If re-sampling is deemed necessary due to laboratory problems, the Contractor and CENWK Project Manager will evaluate the costs/benefits of implementing the additional sampling effort.

11.1 Incoming Samples

Problems noted during sample receipt will be documented in the appropriate laboratory letter-of-receipt (LOR). The Contractor and CENWK Project Manager will be contacted immediately to determine resolution to the problem. All corrective actions will be thoroughly documented.

11.2 Sample Holding Times

When sample extraction/digestion or analytical analyses are not performed within method required holding times, the Contractor and CENWK Project Chemist will be notified immediately to determine resolution to the problem. Resampling is the most probable corrective action for expired holding time. If holding times are exceeded due to laboratory oversight, re-sampling will be conducted at laboratory's expense. All corrective actions will be thoroughly documented.

11.3 Instrument Calibration

Project samples shall not be analyzed by instrumentation which fails to meet tuning and/or standardization/calibration criteria as presented laboratory SOPs and/or QA Plans (referencing Tables 8-1 through 8-3). All project samples will be reanalyzed if performed following an initial and/or continuing calibration analytical sequence that does not meet method requirements. Corrective action may require standard re-preparation, instrument maintenance, and instrument recalibration /restandardization.

11.4 Reporting Limits

All appropriate measures shall be required to prepare samples in an attempt to achieve the reporting limits as stated in Tables 7-1, 7-3, and 7-5. When difficulties arise in achieving these limits, the laboratory will notify the Contractor and CENWK Project Chemist to determine problem resolution. All corrective actions shall be thoroughly documented.

Any dilutions impacting the reporting limits will be documented in case narratives along with revised reporting limits for those analytes affected. Analytes detected above the method detection limits, but below the reporting limits, will be reported as estimated values. Both the undiluted and diluted set of data shall be provided to the Contractor.

11.5 Method Quality Control

Failure of method-required QC to meet the requirements specified in laboratory SOPs/QA Plans (referencing Tables 8-1 through 8-3 of this QAPP) shall require corrective actions for all affected data. The Contractor and CENWK Project Chemist will be notified as soon as possible to discuss possible corrective actions, particularly when unusual or difficult sample matrices are encountered.

11.6 Calculation Errors

When calculation or reporting errors are noted within any given data package, reports will be reissued with applicable corrections. Case narratives will clearly state the reasons for reissuance of reports.

12.0 Calculation of Data Quality Indicators

Laboratory results will be assessed for compliance with required precision, accuracy, completeness, sensitivity and representativeness/comparability as outlined in the following sections.

12.1 Precision

The precision of the laboratory analytical process will be determined through evaluation of the comparative determination of the LCS and LCSD, the MS and MSD, and/or the sample and sample duplicate analyses. Investigative sample matrix precision will be assessed by comparing the analytical results between MS/MSD for organic analysis and laboratory duplicate analyses for inorganic analysis. (MS/MSD pairs may also be prepared for inorganic analyses). The RPD will be calculated for each pair of duplicate analysis using appropriate formulas in Table 12-1 and produce an absolute value for RPD. This precision measurement will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

12.2 Accuracy

The accuracy of the laboratory analytical measurement process will be determined by comparing the percent recovery for the LCS / LCSD versus its documented true value. Overall project accuracy includes the assessment of investigative sample using the analytical results of MS and MSD samples. The percent recovery (%R) of LCS and MS/MSD samples will be calculated using the appropriate formula in Table 12-1. This overall accuracy will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

12.3 Data Completeness

Data completeness of laboratory analyses will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using the following equation:

$$\% \text{ Completeness} = \frac{\text{Number of valid results (non-R flagged)}}{\text{Number of possible results}} \times 100$$

Completeness objectives were defined in Section 3.3.

12.4 Project Completeness

Project completeness will be determined by evaluating the planned versus actual data. Consideration will be given for project changes and alterations during implementation. All data not flagged as rejected by the review, verification, validation, or assessment processes will be considered valid. Overall, the project completeness will be assessed relative to media, analyte, and area of investigation. Completeness objectives were defined in Section 3.3.

12.5 Sensitivity

Sensitivity of the analytical determination is directly related to the laboratory's MDL. Achieving MDLs depends on sample preparation techniques, instrumental sensitivity, and matrix effects. Therefore, it is important to determine actual MDL through the procedures outlined in 40 CFR 136, Appendix C. MDLs should be established for each major matrix under investigation (i.e., concrete, soil, water) through multiple determinations, leading to a statistical evaluation of the MDL.

It is important to monitor instrument sensitivity through calibration blanks and low concentration standards to ensure consistent instrument performance. It is also critical to monitor the analytical method sensitivity through analysis of method blanks, calibration check samples, and LCSs, etc.

12.6 Representativeness/Comparability

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental media examined at the site. It is a qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences. Sample collection, preservation, analytical holding time, analytical method application, and matrix interferences will be evaluated by reviewing project documentation and QC analyses.

Comparability, like representativeness, is a qualitative term relative to the confidence of how one project data set compares with another. The comparability issue is controlled through the use of defined sampling methodologies, use of standard sampling devices, standard analytical protocols/procedures, and QC checks with standard control limits. Through proper implementation and documentation of these standard practices, the project will establish confidence that data will be comparable to other project and programmatic information.

Additional input to determine representativeness and comparability may be gained through statistical evaluation of data populations, chemical charge balances, compound evaluations, or dual measurement comparisons.

13.0 Data Validation, Reduction, and Reporting

This chapter describes the data review process enacted to ensure validity of the analytical data. All data generated by the analytical laboratory will be initially reviewed by the laboratory technical personnel prior to being submitted to the Contractor. This review will provide a check to ensure the correctness of the reported results and generate a case narrative to explain any anomalies which may affect the validity or usability of the data. Following receipt of the data package, the electronic data will be validated by the database and the hardcopy data will be validated by the Contractor chemists or designees.

13.1 Data Reduction

Data reduction requirements apply to both field data and laboratory-generated data.

13.1.1 Field Data

Raw data from field measurements and sample collection activities will be appropriately recorded in field logbooks. Data to be used in project reports will be reduced and summarized. The methods of data reduction will be documented.

The Contractor Project Manager or designee is responsible for data review of all field-generated data. This includes verifying that all field descriptive data are recorded properly, that all field instrument calibration requirements have been met, that all field QC data have met frequency and criteria goals, and that field data are entered accurately in all logbooks and worksheets.

13.1.2 Laboratory Data

All samples collected for the project will be sent to a USACE-approved laboratory. Data reduction, evaluation, and reporting of samples analyzed by the laboratory will be performed according to specifications outlined in both the laboratory's QA Plans and this QAPP. Laboratory reports will include documentation verifying analytical holding time compliance.

The laboratory will perform in-house analytical data reduction under the direction of the Laboratory QA Manager. The Laboratory QA Manager or designee are ultimately responsible for assessing data quality and informing the Contractor and CENWK of any data which are considered "unacceptable" or require caution on the part of the data user in terms of its reliability. Data will be reduced, reviewed, and reported as described in the laboratory QA Plans. Data reduction, review, and reporting activities performed by the laboratory are summarized below:

- Raw data are produced by the analyst who has primary responsibility for the accuracy and completeness of the data. All data will be generated and reduced following the QAPP defined methods and implementing laboratory SOP protocols.

- Level 1 technical data review is completed relative to an established set of guidelines by a peer analyst. The review shall ensure the completeness and correctness of the data while assuring all method QC measures have been implemented and were within appropriate criteria. Items to be reviewed include: preparation logs, analysis runs, methodology, results quality control results, internal QC checks, checklists and sign off sheets.

- Level 2 technical review is completed by the area supervisor or data review specialist. This reviews the data for attainment of QC criteria as outlined in the established methods and for overall reasonableness. It will ensure all calibration and QC data are in compliance, qualitative identification of compounds is correct, quantitative calculations are correct, and check at least 10 percent of the data calculations. This review shall document that the data package is complete and ready for reporting and archival.

- Upon acceptance of the raw data by the area supervisor, the report is generated and sent to the Laboratory Project Manager or QA representative for Level 3 administrative data review. This total overview review will ensure consistency and compliance with all laboratory instructions, the laboratory QA Plans, the project laboratory SOW, and the project QAPP.

- The Laboratory Project Manager will complete a thorough review of all reports.

- Final reports will be generated and signed by the Laboratory Project Manager.

- Data packages, in Contract Laboratory Program (CLP) format, will then be delivered to the Contractor for data validation (refer to Table 13-1).

The data review process will include identification of any out-of-control data points and data omissions, as well as interactions with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project. The laboratory will provide flagged data to include such items as:

- Concentration below required detection limit
- Estimated concentration due to poor spike recovery
- Concentration of chemical also found in laboratory blank

13.2 Data Validation

Data validation is the systematic review process performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use.

13.2.1 Data Validation Approach

The greatest uncertainty in a measurement is often a result of the sampling process and inherent variability in the environmental media rather than the analytical measurement. Therefore, analytical data validation will be performed only to the level necessary to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach is consistent with the DQOs for the project, with the analytical methods, and for determining contaminants of concern and calculating risk.

Samples will be analyzed through use of standard analytical methods. Definitive data will be reported consistent with the deliverables identified in Section 13.1.2 and Table 13-1. This report content is consistent with what is understood as an EPA Level IV deliverable (data forms including laboratory QC, and raw sample data including calibration information). Definitive data will then be validated through the review process presented in Section 13.2.2 and qualified using guidelines established by the analytical method. DQOs identified in Section 3.0 and method-specified criteria will be validated. An additional copy of the comprehensive analytical information will be retained by the subcontract laboratory.

13.2.2 Primary Data Validation Categories

Validation will be performed by comparing the contents of the complete data package (raw data, sample results and QA/QC results) to the requirements established both in the requested analytical methods and the criteria presented in this QAPP. The Contractor Validation support staff will be responsible for these activities. The protocols for analytical data validation are presented in:

- SW-846 Analytical Method Requirements
- EPA CLP National Functional Guidelines for Organic Data Review (EPA 1994b)
- EPA CLP National Functional Guidelines for Inorganic Data Review (EPA 1994c)

The data will be validated using the processes and procedures provided in the National Functional Guidelines, but the guidelines used for control will be the criteria established and presented within the SW-846 methods.

- **Holding Times** - Evaluation of holding times ascertains the validity of results based on the length of time from sample collection to sample preparation or sample analysis. Verification of sample preservation must be confirmed and accounted for in the evaluation of sample holding times. The evaluation of holding times is essential to establishing sample integrity and representativeness. Concerns regarding physical, chemical, or biochemical alteration of analyte concentrations can be eliminated or qualified through this evaluation.

- **Blanks** - The assessment of blank analyses is performed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to any blank associated with the samples, including field, trip, equipment, and method blanks. Contamination during sampling or analysis, if not discovered, results in false-positive data. Blanks will be evaluated against MDLs in accordance with CLP National Functional Guidelines. Field, trip, and equipment rinsate blanks will be evaluated against 5× MDLs for most analytes and 10× the MDLs for common laboratory solvent analytes.

- **Laboratory Control Samples** - The LCS serves as a monitor of the overall performance of the analytical process, including sample preparation, for a given set of samples. Evaluation of this standard provides confidence in or allows qualification of results based on a measurement of process control during each sample analysis.

- **Surrogate Recovery** - System monitoring compounds are added to every sample, blank, matrix spike, MS, MSD, and standard. They are used to evaluate extraction, cleanup, and analytical efficiency by measuring recovery on a sample-specific basis. Poor system performance as indicated by low surrogate recoveries is one of the most common reasons for data qualification. Evaluation of surrogate recovery is critical to the provision of reliable sample-specific analytical results.

- **Internal Standards** - Internal standards are utilized to evaluate and compensate for sample-specific influences on the analyte quantification. They are evaluated to determine if data require qualification due to excessive variation in acceptable internal standard quantitative or qualitative performance measures. For example, a decrease or increase in internal standard area counts for organic compounds may reflect a change in sensitivity that can be attributed to the sample matrix. Because quantitative determination of analytes is based on the use of internal standards, evaluation is critical to the provision of reliable analytical results.

- **Furnace Atomic Absorption Quality Control** - Duplicate injections and furnace post-digestion spikes are evaluated to establish precision and accuracy of individual analytical determinations. Because of the nature of the furnace atomic absorption technique and because of the detailed decision tree and analysis scheme required for quantitation of the elements, evaluation of the QC is critical to ensuring reliable analytical results.

- **Calibration** - The purpose of initial and continuing calibration verification analyses is to verify the linear dynamic range and stability of instrument response. Relative instrument response is used to quantitate the analyte results. If the relative response factor is outside acceptable limits, the data quantification is uncertain and requires appropriate qualification.

- **Sample Reanalysis** - When instrument performance-monitoring standards indicate an analysis is out of control, the laboratory is required to reanalyze the initial sample. If the analysis is out of control again, the sample must then be re-prepared and analyzed. If the reanalyses do not solve the problem (i.e., surrogate compound recoveries are outside the limits for both analyses), the laboratory is required to submit data from both analyses. An independent review is required to determine which is the appropriate sample result.

- **Secondary Dilutions** - When the concentration of any analyte in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and reanalyzed. The laboratory is required to report data from both analyses. When this occurs, an independent review of the data is required to determine the appropriate results to be used for that sample. An evaluation of each analyte exceeding the calibration range must be made, including a review of the dilution analysis performed. Results chosen in this situation may be a combination of both the original results (i.e., analytes within initial calibration range) and the secondary dilution results.

- **Raw Data (inc. Chromatograms and Intensity/Absorbance Readings)** - Raw data will be used to assess the qualitative and quantitative assumptions and decisions made by the laboratory and determine whether the decisions made within the laboratory are substantiatible from a third party position. Retention times and identifications of tentatively identified compounds are verified.

- **Laboratory Case Narratives** - Analytical laboratory case narratives are reviewed for specific information concerning the analytical process. This information is used to direct the data validator to potential problems with the data.

13.3 Data Reporting

The analytical laboratory will provide all project data in both hardcopy and electronic format as discussed below. The laboratory will also be required to confirm sample receipt and log-in information. The laboratory will return a copy of the completed COC and confirmation of the laboratory's analytical log-in to the Contractor within 24 hours of sample receipt.

For all (100%) project data, the subcontract analytical laboratory will prepare and deliver a full copy of an analytical data package as required for CLP Level III. At a minimum, the following information will be provided in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis
- Tabulated results of inorganic, organic, and other parameters identified and quantified
- Analytical results for QC sample spikes, sample duplicates, initial and continuous calibration verifications of standards and blanks, standard procedural blanks, LCSs, etc.

Additionally, upon review of the Level III data deliverables, the Contractor will randomly select 10% of the data packages for Level IV validation as described below. At the request of the Contractor, the analytical laboratory will provide a CLP Level 1V data package for the specified results. The Level IV package will include all Level III information in addition to the following:

- Associated raw data to support the tabulated results for samples and QA/QC
- Tabulation of instrument detection limits determined in pure water.

The lab is required to retain a full copy of the analytical and QC documentation. Such retained documentation will include all hard copies and electronic storage media (e.g., magnetic tape). As needed, the analytical laboratory will supply hard or electronic copies of the retained information.

The data are required to be formatted in a database format, as specified by the Contractor, to facilitate electronic data entry, review, and evaluation. The electronic data set will be transferred automatically into the project database. Following the transfer, the data set will be validated to an equivalent EPA Level III validation review. As part of the review, an error report will be generated from the database, which includes data flags in accordance with the above-referenced protocols. The report will be accompanied with additional comments of the data validator(s). The associated data flags will include such items as: (1) estimated concentration below-required reporting limit; (2) estimated concentration due to poor calibration, internal standard, or surrogate recoveries; (3) estimated concentration due to poor spike recovery; and (4) estimated concentration of chemical that was also determined in the laboratory blank. The EPA Level III validation review will apply to 100% of project data.

After the electronic validation has been performed, an EPA Level IV validation on a minimum of 10% of the data will be performed by qualified chemists. Flags signifying the usability of data will be noted and entered into an analytical data base. Deficiencies in data deliverables will be corrected through direct communication with the laboratory, generating immediate response and resolution. All significant data discrepancies noted during the validation process will be documented through NCRs, which are sent to the laboratory for clarification and correction. Decisions to repeat sample collection and analyses may be made by the Contractor Project Manager and the Project Chemist based on the extent of the deficiencies and their importance in the overall context of the project.

Data assessment will be accomplished by the joint efforts of the data validator, the Project Chemist and the Project Manager. Data assessment will be based on the criteria that the sample was properly collected and handled according to the FSP and QAPP. An evaluation of data accuracy, precision, sensitivity and completeness, based on criteria presented in this QAPP, will be performed by the data validator and presented in the QCSR. This data quality assessment will indicate that data are: (1) usable as a quantitative concentration, (2) usable with caution as an estimated concentration, or (3) unusable due to excessive out-of-control QC results.

Project data sets will be available for controlled access by the Contractor Database Manager and other authorized personnel. Each data set will be incorporated into project reports as required.

13.4 Data Turnaround Time Requirements

The turnaround time for analytical deliverables for the Building 3 sampling effort is 7 days, although the Contractor is not restricted from requiring accelerated turnaround times upon request. Sufficient notification time will be provided by the Contractor prior to decreasing the turnaround time.

14.0 Performance and System Audits

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and QAPP. Audits of laboratory activities will include both internal and external audits.

14.1 External Laboratory Audits

The USACE HTRW CX conducts on-site audits and validates laboratories on a regular basis. These USACE independent on-site systems audits in conjunction with performance evaluation samples (performance audits) qualify laboratories to perform USACE environmental analysis every 18 months.

These system audits include examining laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Performance audits consist of sending performance evaluation samples to USACE laboratories for on-going assessment of laboratory precision and accuracy. The analytical results of the analysis of performance evaluation samples are evaluated by USACE HTRW CX to ensure that laboratories maintain an acceptable performance.

14.2 Internal Laboratory Audits

Internal performance and system audits of laboratories will be conducted by the Laboratory QA Officer as directed in the laboratory QA Plans. These system audits will include examination of laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Internal performance audits are also conducted on a regular basis. Single-blind performance samples are prepared and submitted along with project samples to the laboratory for analysis. The Laboratory QA Officer will evaluate the analytical results of these single-blind performance samples to ensure that the laboratory maintains acceptable performance.

15.0 QA Reports and Documentation

This section describes the primary quality assurance reports to be prepared by the Contractor and submitted to USACE project management.

15.1 Daily Chemical Data Reports

During field activities, the Contractor will prepare Daily Quality Control Reports (DQCRs) as described in the FSP. In addition to the item specified in the FSP, a daily analytical data report will be included as an attachment to the DQCR. This report will present tabulated analytical results for data that was received since the prior DQCR was submitted to USACE.

15.2 Laboratory Quality Assurance Reports

Each laboratory will provide LORs and analytical QC summary statements (case narratives) with each data package. All COC forms will be compared with samples received by the laboratory and a LOR will be prepared and sent to the Contractor describing any differences in the COC forms and the sample labels or tags. All deviations will be identified on the receiving report such as broken or otherwise damaged containers. This report will be forwarded to the Contractor within 24 hours of sample receipt and will include the following: a signed copy of the COC form; itemized sample numbers; laboratory sample numbers; cooler temperature upon receipt; and itemization of analyses to be performed. Summary QC statements will accompany analytical results as they are reported by the laboratory in the form of case narratives for each sample delivery group.

15.3 Quality Control Summary Reports

At the conclusion of field investigation activities and laboratory analysis, the Contractor, in addition to any review conducted by the laboratory, will perform its own validation of the submitted data. This activity will include assignment of flags to data, documentation of the reason(s) for the assignments, and description of any other data discrepancies. The Contractor will then prepare a Quality Control Summary Report (QCSR), which will be included as an appendix to the final report. This report will be submitted to the CENWK Project Manager as determined by the project schedule. The contents of the QCSR will include data validation documentation and discussion of all data that may have been compromised or influenced by aberrations in the sampling and analytical processes. Both field and laboratory QC activities will be summarized, and all DQCR information will be consolidated. Problems encountered, corrective actions taken, and their impact on project DQOs will be determined.

The following are examples of elements to be included in the QCSR, as appropriate:

- Laboratory QC evaluation and summary of the data quality for each analytical type and matrix. Part of the accuracy, precision, and sensitivity summarized in the data quality assessment.
- Field QC evaluation and summary of data quality relative to data useability. Part of the accuracy, precision, and sensitivity summarized in the data quality assessment.
- Overall data assessment and usability evaluation.
- DCQCR consolidation and summary.
- Summary of lessons learned during project implementation.

Specific elements to be evaluated within the QCSR include the following:

- Sample results
- Field and laboratory blank results
- Laboratory control sample percent recovery (method dependent)
- Sample matrix spike percent recovery (method dependent)
- Matrix spike/matrix spike duplicate or sample duplicate RPD (method dependent)
- Analytical holding times
- Surrogate recovery, when appropriate.

15.4 Field Work Variances

Any departures from approved plans will receive prior approval from the CENWK Project Manager and will be documented via Field Work Variances (FWVs) as discussed in Section 9.3 of the FSP. FWVs will be incorporated into the project evidence file.

15.5 Project Evidence Files

The Contractor will maintain custody of the project evidence file and will maintain the contents of files for this project, including all relevant records, reports, logs, field logbooks, pictures, subcontractor reports, correspondence, and COC forms, until this information is transferred to the CENWK Project Manager. These files will be stored under custody of the Contractor Project Manager. The analytical laboratory will retain all original analytical raw data information (both hard copy and electronic) in a secure, limited access area and under custody of the laboratory Project Manager.

16.0 References

ASTM (American Society of Testing and Materials). 1996. *Annual Book of ASTM Standards, Volume 04.08, Soil and Rock.*

EPA (U. S. Environmental Protection Agency) 1985. *NEIC Policies and Procedures, EPA-300/9-78DDI-R*, Revised June.

EPA 1991. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QA/R5*, revised October

EPA 1993a. *Data Quality Objectives Process, EPA-540-R-93-071*, September.

EPA 1993b. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition*, *Revision 1, Update 1*.

EPA 1994a. *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5*, January.

EPA 1994b. *EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-94/012*, February.

EPA 1994c. *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA-540/R-94/013*, February.

USACE (U. S. Army Corps of Engineers) 1994. *Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3*, September.

USACE (U. S. Army Corps of Engineers) 1998. *Chemical Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities, ER 1110-1-263*, April.

REPLACEMENT TEXT - PART 2 OF APPENDIX A (QAPP)

REPLACEMENT COVER AND TEXT (2 PAGES ONLY) - APPENDIX B OF RA WORK PLAN (SHERP)

SAFETY, HEALTH, AND EMERGENCY RESPONSE PLAN
REMOVAL OF PCB TSCA WASTE
BUILDING 3
ST. LOUIS ARMY AMMUNITION PLANT
ST. LOUIS, MISSOURI
(Revision 1)

PRE-PLACED REMEDIAL ACTION CONTRACT
CONTRACT NO. DACW41-00-D0019
TASK ORDER NO. 0002

Submitted to:

Department of the Army
U.S. Army Engineer District,
Kansas City Corps of Engineers
700 Federal Building
601 East 12th Street
Kansas City, Missouri 64106

Department of the Army
Aviation and Missile Command
Building 3206 Redstone Arsenal
Huntsville, Alabama 35898

Submitted by:

Arrowhead Contracting, Inc.
12920 Metcalf Avenue, Suite 150
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November 8, 2001

Work at heights, including man lifts and ladders, is addressed in Section 5.2.4.

According to OSHA standards, holes in walking/working surfaces that present a potential for employees to fall 6 feet or more shall be protected. The fall protection methods that may be used during the Removal Action include the following:

- Guard rail systems or floor covers
- Personal fall arrest systems
- Barricades/warnings (controlled access)
- Safety monitoring

The fall protection methods will vary depending on the conditions or situation as follows:

- The chip chute opening will be covered in accordance with OSHA standards.
- The wall opening on the second floor will be protected by means of a guard rail in accordance with OSHA standards.
- During active concrete floor removal, floor openings may be temporarily unprotected on one or more edges while saw cuts are being made for adjacent flooring. Workers who may potentially approach unprotected edges will be required to use personal fall arrest devices (such as self-retracting lifelines). Safety monitoring will also be provided. Barricades will be erected to protect the remaining edges of flooring.
- Temporary barricades (such as construction fencing) will be placed around the perimeter of completed open flooring while work is in progress elsewhere. As part of site restoration activities, chain-link fencing (or equivalent guardrail systems) will be installed around the perimeter of each floor opening or group of floor openings.

A guard rail system is defined by OSHA as "a fixed barrier erected as an engineering control to prevent employees from falling to a lower level." The following guidelines apply to the construction and use of guard rails:

- Height of the top rail edge shall be 42 inches $\pm$ 3 inches above the working level.
- Midrails shall be installed midway between the top rail and working level.
- Guardrail system shall be capable of withstanding 200 pounds of force applied outward or downward within 2 inches of the top edge of the guardrail at any point (midrails shall have 150 pound capacity).
- Guardrail system shall be constructed to prevent puncture or laceration to personnel or equipment, or snagging of clothing.
- Top rails and midrails shall be at least one-quarter of an inch-thick to prevent cuts/lacerations.

- Toeboards shall be installed whenever personnel are working above other personnel to prevent tools or debris from being kicked out, falling, and striking the people below.
- Personnel shall not lean on guardrails or rest equipment against guardrails.
- Inspect guardrails regularly for defects, and replace/rebuild defective components immediately.

The use of covers to control fall hazards shall meet the following requirements:

- Existing holes that could permit objects to fall and strike personnel below shall also be protected with covers.
- Covers shall be capable of supporting at least twice the weight of employees expected to walk over the cover. [Note: Personnel performing field activities at Building 3 will not need to walk over the cover.]
- Covers shall be secured to prevent displacement by equipment or employees.
- Covers shall be marked with signs or other hazard warnings such as "Do not remove - open hole."

Personal fall arrest systems shall be used when other controls are not feasible to control a fall hazard of 6 feet or more. Personal fall arrest systems are specified as follows:

- Components of a personal fall arrest system include a body system (e.g., harness), connecting device (e.g., rope or web lanyard, shock absorbing lanyard, self-retracting lifeline), and a tie-off or anchorage point (5,000 pounds per worker; eye bolt or beam).
- Only American National Standards Institute (ANSI) approved fall protection equipment shall be used.
- Use lanyards with locking snaphooks only. Non-locking snaphooks are not acceptable, since they may contribute to roll out.
- Dee-rings, snap hooks, and attachment straps shall have 5,000 pounds of tensile strength.

Personal fall arrest systems shall be used as follows:

- Use a portable anchorage point (e.g., cross arm strap, fixed beam anchor) to connect the lanyard to the anchorage point when there is no eye bolt for direct attachment. Hitching the lanyard onto itself as a choker is never allowed.
- Attach connecting devices to the D-ring in the middle of the back.
- Locate anchorage points at or above the D-ring attachment point in the middle of the back.
- Do not work above the tie-off anchor point. If it is necessary to work above the tie-off point, reposition the tie-off anchor point to a point above the middle of the back.

Personnel shall inspect personal fall arrest systems prior to each use using the following guidelines:

REPLACEMENT APPENDIX D - RA WORK PLAN

Appendix D

Structural Engineering Recommendations

WIDEMAN & ASSOCIATES, INC.
ENGINEERS • CONSULTANTS

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October 30, 2001

Mr. Greg Wallace
Arrowhead Contracting
12920 Metcalf, Ste 150
Overland Park, KS. 66213

Dear Greg:

RE: St. Louis Armory
Slab Removal

This letter is to summarize my results from evaluating the 1st and 2nd floor slabs for removal of contaminated portions. Please review the attached 16 pages of calculations for reference. Calculations were based on slab removal in 6'-8" X 5'-0" pieces for the 8" thick slab areas supported by beams, and 5'-0" X 5'-0" pieces for the 15" thick slab area with intermediate columns and no beams.

The 2nd floor slab is supported by beams at 6'-8" o.c., and was evaluated for its capacity as simply supported. A gantry crane load was considered as well as a live load of 40 psf, in addition to dead loads and the weight of the cut slab piece. The 2nd floor slab was determined to be adequate for the loading. The 2nd floor beams were also determined to be adequate to support the loads.

The 1st floor slab that was supported by beams was evaluated as a simple span, and considered for the loading of the IC-80-1F crane (information provided by you) as well as the weight of the slab piece and a live load of 40 psf. It was determined that during picking, the crane should be on its rubber tires (not outriggers), and that the tires should be centered on the W18 beams below. In addition, no pick should be made any further than 12 ft. (horizontal distance) to the closest tire. The beams were determined to be adequate for the loads.

The 1st floor slab area with the 15" thick slab and intermediate columns (no steel beams) was evaluated for the IC-200-1C crane load as well as the slab piece and a larger 60 psf live load. The slab was determined to be adequate for the loading if the pick is made on the outriggers and adequate cribbing is provided to spread the load under each outrigger to a minimum of 3'-6" X 3'-6". Furthermore, no pick shall be made at a distance greater than 12'-6" from the closest outrigger. Because of this restraint, the removal of all pieces within a quarter section of bay cannot be done with the crane only in 1 set position. This should be taken into account when determining the order of saw cuts and picks, being sure that the crane will have an adequate area of uncut 15" slab to pick from and still be within 12'-6" of the pick.

Mr. Greg Wallace
Arrowhead Contracting

It should also be noted that this area of the slab was evaluated conservatively as a one way simple span, and the "column strips" remaining in the opposite direction of the cuts are adequate to support the slab. However, since the column strips for 2 way slab support were determined to be 2'-6" to each side of the intermediate columns, and since less removal would be required if these strips were left in tact, it is advisable to leave 2'-6" of slab to the inside face of the intermediate columns (see sketch on sheet 10 of 16). The crane should not be set in a position that would apply load to this cantilevered 2' X 6" portion.

There was some previous discussion concerning the beams along the perimeter of the slab, and their ability to withstand lateral loading if the slab was removed. On the 2nd floor there are no areas in which the perimeter slab is removed, and on the 1st floor the slab sits directly on the foundation wall.

There was additional concern about this discontinuity in the slab diaphram due to the removed sections. It was determined the 2nd floor alone had plenty of remaining slab to take the majority of the horizontal wind shear, and in the areas of perimeter slab removal on the 1st floor the steel support beams perpendicular to the wall shall remain and be adequate to transfer the lateral loading to the remaining areas of slab.

Finally, sheet 16 shows typical shoring required at the thick slab area for each slab section that is to be cut.

Should you have any further questions, please feel free to call.

Sincerely,

Tony L. Blaylock

Tony L. Blaylock, PE
Wideman & Associates, Inc.

TLB/bw

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BY RW DATE 10-30-01 SUBJECT ST. LOUIS ARMORY SHEET NO. ____ OF ____
ARROWHEAD CONTR. JOB NO. ____
SLAB REMOVAL

THIS SEAL COVERS ATTACHED CALCULATION SHEETS 1 THRU 16.

STATE OF MISSOURI
R. LEON WIDEMAN
NUMBER E-14402
REGISTERED PROFESSIONAL ENGINEER

10-30-01

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BY TLB DATE 10/24/01 SUBJECT ARROWHEAD CONTRACTING
✓ RLW
ST. LOUIS ARMORY JOB NO.
SLAB DEMO

GIVEN

- CRANE WILL PICK SLABS FROM 1^{ST} FLOOR
- GANTRY CRANE WILL BE USED ON 2^{ND} FLOOR TO LOWER SLABS TO 1^{ST} FLOOR

SIZE OF CUT PIECE : 2^{ND} FLOOR : 6'-8" × 5'
1^{ST} FLOOR (BEAM AREA) : 6'-8" × 5'
1^{ST} FLOOR (2 WAY SLAB AREA) : 5' × 5'

WT OF CUT PIECES :
6'8" × 5' PIECES ⇒ 5½" THK w/ 2½" TOPPING (RANGES TO 3" TOPPING)
WT : $150\left(\frac{8}{12}\right)(6.67)(5) = \underline{3335}$ # ±

5' × 5' PIECE ⇒ 15 - 16" THK
(ASSUMED 12" STRUCTURAL w/ 3" TOPPING)
WT : $150\left(\frac{16}{12}\right)(5)(5) = \underline{5000}$ #

HEAVIEST CRANE : 27,640 # 8' BETWEEN WHEELS
SMALLER CRANE : 16,900 #

GANTRY : ASSUMED 4 LEGS
TOTAL WT ⇒ EST 1000 # (CONSERVATIVE)

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BY TLB DATE 10/25/01 SUBJECT ARROWHEAD CONTRACTING SHEET NO. 2 OF 16
ST. LOUIS ARMORY JOB NO.
✓ RW SLAB DEMO

EVALUATE 2ND FLOOR

TYPICAL 2ND FLOOR SLAB LINES (1) - (28)
FIN FLOOR ELEVATION 139.42'

5½" CONC SLAB (+3" TOPPING)
SUPPORTED BY W18×55 BEAMS @ 6'-8" O.C.
W18×55's SPAN 20'-0" BETWEEN SUPPORTS

LOADS

D.L.: SLAB WT. $\left(\frac{8.5}{12}\right)150 = 106.25$ PSF ⇒ USE 107 PSF
BEAMS W18×55 = ⇒ 55 PLF

L.L.: CUT SLAB PIECE/2 = $3335/2$ ⇒ 1668 LB
GANTRY CRANE = $1000/4$ ⇒ 250 LB/PT
FLOOR L.L. (CONSTRUCTION LD) = USE 40 PSF ⇒ 40 PSF

MAX DESIGN CONDITION FOR 2ND FLOOR
- SIMPLE SPAN
- GANTRY PICKING SLAB, SLAB OVER TO 1 SIDE OF GANTRY (2 LEGS)
- FOR SLAB - GANTRY LOAD @ CTR OF SLAB SPAN
- FOR BEAM - GANTRY LOAD ON BEAM @ CTR

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BY TLB DATE 10/25/01 SUBJECT ARROWHEAD CONTRACTING SHEET NO. 3 OF 16
ST. LOUIS ARMORY JOB NO.
– Rlee SLAB DEMO

2ND FLOOR SLAB EVALUATION

$t = 5.5$ in

$d \cong 4.5$ in

1/2" ø BAR ⇒ EQ #4 @ 6" O.C. (1/2 BENT, 1/2 STRAIGHT)

$A_{st}/_{\text{PER BAR}} = 0.20\ \text{in}^2$

$A_{st}/_{\text{FT WIDTH}} = 0.4\ \text{in}^2/\text{FT}$

FACTORED LOAD: 1.7 LL + 1.4 D.L.

L.L.: 1.7 (250) + 1.7 (1668) = $\underline{3261}$ # (SLAB WT ONLY ON 2 LEGS)

1.7 (40) = 68 PSF

D.L.: 1.4 (107) = 150 PSF ⇒ 150 PLF/FT

$M_R = \frac{\phi b d^2}{12} \bar{k}$ $\rho_{\text{PER FT}} = \frac{.4}{(4.5)(12)} = 0.0074$

ASSUMED $f'_c = 3{,}000$ PSI $\bar{k} = 0.2788$

$F_y = 40$ ksi

$M_{R\,(\text{PER FT})} = \frac{.9(12)(4.5)^2(.2788)}{12} = 5.08\ \text{K}\cdot\text{FT}$

$M_u = \frac{PL}{4} + \frac{wl^2}{8} = \frac{3.26(6.67)}{4} + \frac{(.15+.068)(6.67)^2}{8} = 6.64\ \text{K FT}$

STRIP WIDTH REQ ⇒ $\frac{6.64}{5.08} = 1.3$ FT

* SO THIS ASSUMES A 1.3 FT STRIP OF SLAB SUPPORTS THE MAX CASE LOADING ⇒ $\underline{\text{O.K.}}$ BY INSP

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ST. LOUIS ARMORY JOB NO.
~ Riw SLAB DEMO

2ND FLOOR SLAB CONT.

CHECK SHEAR:

CONC. ALONE

$V_c = 2\sqrt{f'_c}\, b_w d = 2\sqrt{3000}\,(36)(4.5) = 17{,}746^{\#}$ O.K. BY INSP

2ND FLOOR BEAMS

MAX CASE → GANTRY LOAD OVER CTR OF BM

$w = 6.67(107 + 40) + 55 = 1034$ PLF

$P = 1668 + 250 = 1918^{\#}$

$M_{max} = \frac{1.034(20)^2}{8} + \frac{1.918(20)}{4} = 61.29$ FT. KIPS

WORST CASE → NO LATERAL SUPPORT GIVEN BY SLAB (VERY CONSERVATIVE)

W18×55 $S_x = 98.3\ in^3$ $d/A_f = 3.82$

$F_b = \frac{12000}{20(12)(3.82)} = 13$ ksi

$S_{req} = \frac{61.29 \times 12}{13} = 57\ in^3 < 98.3\ in^3$ O.K.

$\boxed{\text{W18×55}}$ O.K.

2ND FLOOR BEAM @ SLAB PERIMETER

* NO CASE OF 2ND FLOOR REMOVAL @ PERIMETER SLAB ⇒ O.K.

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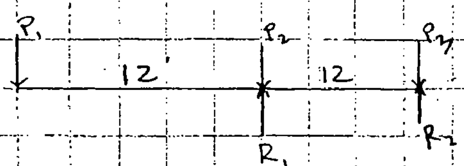
ST. LOUIS ARMORY JOB NO.
~ Ri SLAB DEMO

1ST FLOOR - BEAM - SLAB AREA

- EVALUATE SLAB AS SIMPLE SPAN L = 6'8"

WORST CASE: CRANE PICKING OVER 1 OUTRIGGER
BOOM EXTENDED OUT AS FAR AS CRANE CAN PICK LOAD (12')
FLOOR L.L. = 40 PSF

CRANE WT 16,900#
WT / OUTRIGGER = 4225#
OUTRIGGERS 12' APART



$P_1 = 3335^{\#}$
$P_2 = 4225^{\#}$
$P_3 = 4225^{\#}$

ΣM_{R_2}: $12R_1 = 24(3335) + 12(4225)$
$R_1 = \underline{10,895}^{\#}$

$R_2 = 3335 + 4225 + 4225 - 10895 = \underline{890}^{\#}$

FACTORED LOAD
$P_u = 1.7(10,895) = 18,522^{\#}$
$w_u = 1.7(40) = 68$ PLF / FT WIDTH

$w_{DL} = 1.4(107) = 150$ PLF / FT WIDTH

SLAB: $d = 4.5"$
½" Ø BARS @ 6" C.C. (ALT BENT & STRAIGHT)

FROM SHT. 3, $M_{R\,(PER\ FT)} = \underline{5.09\ K\cdot FT}$

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$M_u = \frac{18.5(6.67)}{4} + \frac{(.15+.068)(6.67)^2}{8} = 32$ FT·KIPS

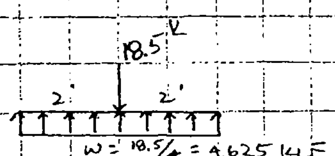
CRIBBING LENGTH REQ: $\frac{32}{5.09} = 6.29'$ (NEARLY FULL SPAN)

BUT, CRIBBING WILL SPREAD LOAD

TRY 6×6 CRIBBING 6×6 $S = 30.25\ in^3$

$M_R = 1100\ psi\,(30.25\ in^3)(\frac{1}{12}) = 2773$ FT·LB PER 6×6

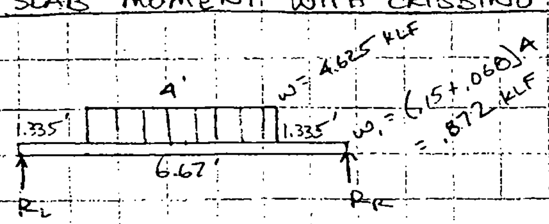
SAY SPAN 4'



$M_{MAX} = \frac{1}{2}(2)^2(4625) = 9250$ FT·LB

REQUIRES 2 LAYERS, 4 - 2×6's TOP
9 - 2×6's BOTTOM
(PERPENDICULAR)

NEW SLAB MOMENT WITH CRIBBING



$R_R = R_L = \frac{1}{2}(6.67)(.872) + \frac{1}{2}(4)4.625 = 12.2^K$

$M_{MAX} = 3.335(12.2) - \frac{1}{2}(3.335)^2(.872) - \frac{1}{2}(2)^2(4.625) = 26.6$ FT·KIPS

$M_R = 4(5.09) = 20.36$ FT·KIPS

STILL NO GOOD

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ST. LOUIS ARMORY JOB NO.
✓ RW SLAB DEMO

SO, MUST PICK WITH CRANE ON WHEELS, NOT OUTRIGGERS

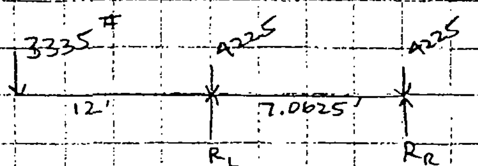
WHEEL SPACING => 6'6" WHICH IS VERY CLOSE TO SPAN

$\boxed{\text{CENTER CRANE IN SPAN SO THAT WHEELS ARE OVER BEAMS}}$

WHEEL SPAN = 7.0625'

$w_1 = 6.67(107 + 40) = 981$ PLF
$w_2 = 55$ PLF (BM)

CRANE LOAD:



ΣR_R: $7.0625 R_L = 19.0625(3335) + 7.0625(4225)$
$R_L = 13,227$#

$R_R = 2(4225) + 3335 - 13227 = -1442$#
OR 1442# ↓
SO, BACK END IS PICKING UP

WOULD HAVE TO BE LESS OF A REACH

ΣM_{R_L}: $7.0625(4225) = x(3335)$
$x \cong 9'$ (BUT, FROM CHART - $P_{ALLOW} \cong 12'$)

SO, CONSERVATIVELY USE $x = 12'$
$R_L = 13.2^k$
$R_R = \underline{\underline{0}}^k$

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BY TLB DATE 10/26/01 SUBJECT ARROWHEAD CONTRACTING SHEET NO. 8 OF 16
✓ KW ST. LOUIS ARMORY JOB NO.
SLAB DEMO

CHECK W18×55 $L = 20'$

MAX CASE ⇒ LOAD @ $\bar{x} = 10'$

$$M_{max} = \frac{(.981 + .055)(20)^2}{8} + \frac{13.2(20)}{4} = 118 \text{ k·FT}$$

- BEAM FLANGES ARE POURED INTO BOTTOM OF SLAB, THEREFORE ARE LATERALLY SUPPORTED

$$S_{req} = \frac{118 \times 12}{24} = 59 \text{ in}^3$$

$\boxed{W18 \times 55}$ $S = 98.3 \text{ in}^3$ $\boxed{O.K.}$

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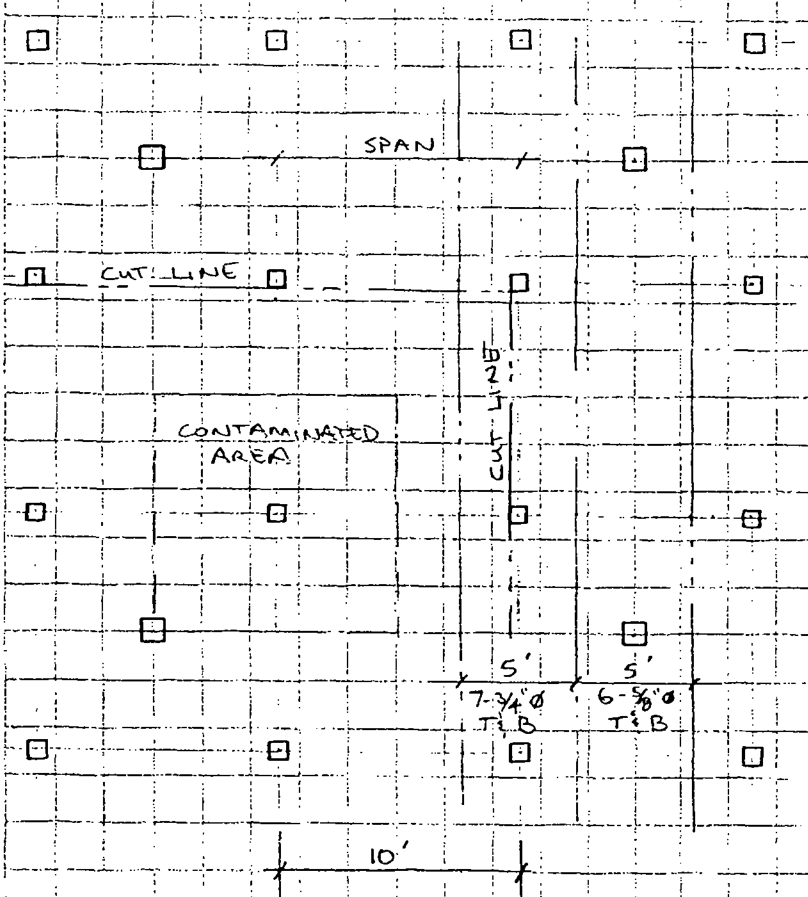
BY TLB DATE 10/29/01 SUBJECT ARROWHEAD CONTRACTING / ST. LOUIS ARMORY / SLAB DEMO JOB NO.

✓ Rw

CHECK THICKER SLAB AREA W/ INTERMEDIATE COLS & NO BEAMS



* 12" THK STRUCTURAL SLAB
3" TOPPING
REINFORCING THE SAME BOTH DIRECTIONS

WT. OF SLAB : $\frac{15}{12}(150) = 188$ PSF

WORST CASE : IF LOSE 2 WAY ACTION, COMPUTE AS 1 WAY SIMPLY SUPPORTED

COMPUTE COLUMN STRIP

$w = 0.25\,l = 0.25(10) = 2.5'$ (EACH SIDE OF PANEL)

SO → SUPPORT BM IS 5' WIDE W/ 7-3/4"Ø BARS T & B

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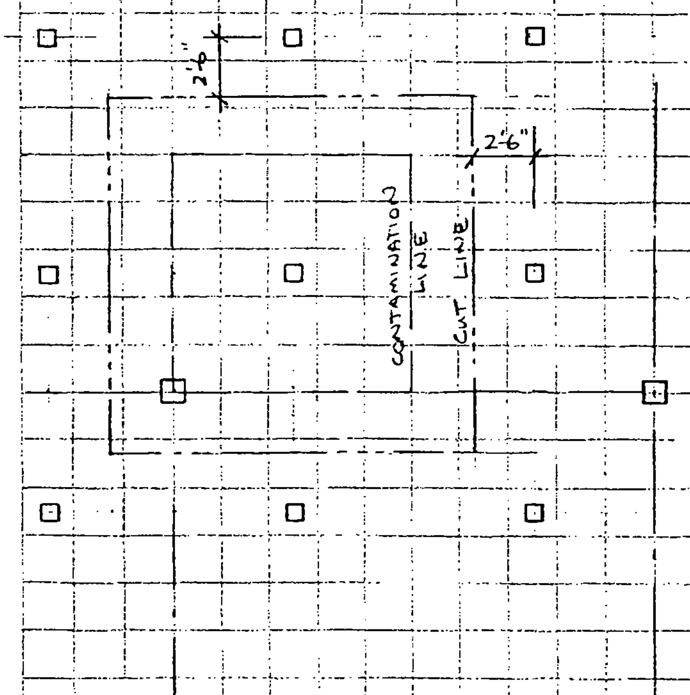
BY TLB DATE 10/29/01 SUBJECT ARROWHEAD CONTRACTING SHEET NO. 10 OF 16
ST. LOUIS ARMORY JOB NO.
/ Rev SLAB DEMO

* IF CUT IS MADE NEAR INSIDE OF COLUMNS, COLUMN STRIP WILL LOOSE IS CONTINUOUS ACTION => BETTER TO LEAVE 2.5' BUT FOR CONSERVATIVE, CALCULATE AS SIMPLY SUPPORTED COLUMN STRIP



CHECK CAPACITY OF SLAB ALONE AS SIMPLY SUPPORTED

$\ell = 10'$ (CONSERVATIVE)

IN 5' => 6 BARS, SO, AVG 10" APART => 5/8" BARS T & B

ASSUMED LOADS

L.L. = 60 PSF (CONSTRUCTION LOAD - NOT INCL CRANE)

D.L. = 188 PSF

$P_u = 1.7(60) + 1.4(188) = 365.2$ PSF

* NOTE: CRANE LOAD IS NOT FACTORED BECAUSE AN ACCURATE LOAD CAN BE CALCULATED

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BY TLB DATE 10/29/01 SUBJECT ARROWHEAD CONTRACTING
ST. LOUIS ARMORY
SLAB DEMO

JOB NO.

✓ Riew

THK SLAB EVALUATION CONT:

CONSIDER 1 FT STRIP OF SLAB:

$w_u = 365.2$ PLF

$$M_u = \frac{365.2(10)^2}{8} = 4565 \text{ FT·LB} = 4.57 \text{ FT·KIPS}$$

$$M_R = \frac{\phi b d^2}{12}\bar{K}$$

$d = 10"$ MIN (ONLY TENSILE STEEL CONTRIBUTING)

$$A_s = \frac{0.31 \text{ in}^2}{10/12} = 0.372 \text{ in}^2/\text{FT}$$

$$\rho = \frac{.31}{(10)(10)} = .0031$$

ASSUME $f'_c = 3000$ psi $F_y = 40{,}000$ psi

$\bar{K} = 0.1210$

$$M_R = \frac{.9(12)(10)^2}{12}(.1210) = 10.89 \text{ FT·KIPS} > 4.57 \text{ FT·KIPS} \quad \text{O.K.}$$

SLAB O.K. AS SIMPLY SUPPORTED

CHECK 2'-6" CANTELEVER

$$M_{MAX} = \tfrac{1}{2}(2.5)^2(.365) = 1.14 \text{ FT·KIPS} < 10.89 \text{ FT·KIPS} \quad \text{O.K.}$$

$\boxed{\text{2'-6" CANTELEVER O.K.}}$

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CHECK BEAM STRIP

$b = 5'$

$w = 10(365.2) = 3652$ PLF

$7 - \tfrac{3}{4}"\phi$ BARS $\Rightarrow$ $\rho = \dfrac{7(.44)}{10(5)(12)} = .005133$

$\bar{K} = 0.1958$

$M_R = \dfrac{.9(60)(10)^2}{12}(.1958) = 88.1$ FT·KIPS

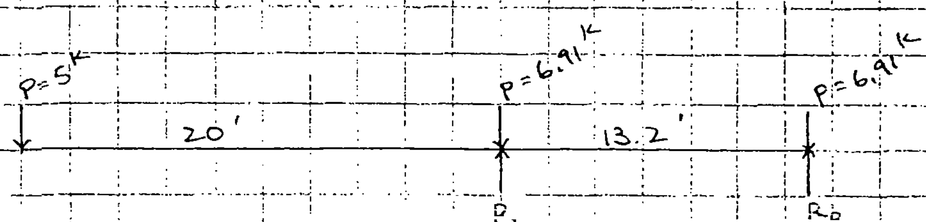
$M_u = \dfrac{3.65(10)^2}{8} = 45.6$ FT·KIPS $<$ 88.1 FT·KIPS O.K.

CHECK SLAB FOR CRANE LOAD

HEAVIER CRANE $\Rightarrow$ $W_T = 27{,}640^{\#}$ PER OUTRIGGER $P = 6910^{\#}$

WT. OF SLAB PIECE $= 5000^{\#}$

MAX DISTANCE OF PICK $\Rightarrow$ USE 20FT



ΣM_{R_R}: $13.2 R_L = 33.2(5) + 13.2(6.91)$

$R_L = 19.49^k$

$R_R = 5 + 6.91 + 6.91 - 19.49 = -0.67^k$ ↑

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BY TLB DATE 10/29/01 SUBJECT ARROWHEAD CONTRACTING SHEET NO. 13 OF 16
ST. LOUIS ARMORY JOB NO.
✓ Rw

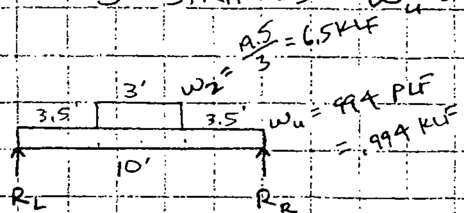
CHECK SLAB SPAN BETWEEN COL. STRIPS

ASSUME 3' OF CRIBBING MINIMUM

CONSTRUCTION L.L. AROUND CRANE ⇒ 40 PSF

$P_u = 1.4(188) + 1.7(40) = 331$ PSF

3' STRIP ⇒ $w_u = 3(331) = 994$ PLF



$R_L = R_R = \frac{1}{2}(6.5)3 + \frac{1}{2}(.994)10 = \underline{14.72^K}$

$M_{u \text{ @ CTR}} = 14.72(5) - \frac{1}{2}(5)^2(.994) - \frac{1}{2}(1.5)^2 6.5 = 53.9$ FT·KIPS

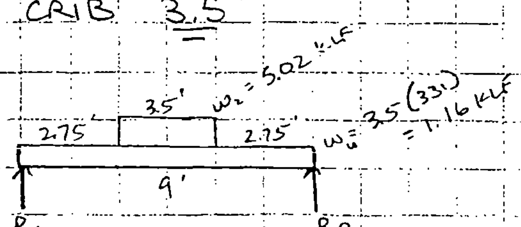
$M_R = 3(10.89) = 32.7$ K·FT N.G.

SO, PICK MUST BE SHORTER

TRY MAX PICK AT 15' : $R_L = \underline{17.6^K}$

CLEAR SPAN BETWEEN COLS = 9' NOT 10'

∴ CRIB 3.5'



$R_L = R_R = \frac{1}{2}[5.02(3.5) + 9(1.16)] = 14^K$

$M_{MAX} = 14(4.5) - \frac{1}{2}(4.5)^2(1.16) - \frac{1}{2}(1.75)^2(5.02)$
$= 43.6$ K·FT

$M_R = \frac{.9(3.5)(12)(10)^2}{12}(.121) = 38.1$ K·FT CLOSER, BUT N.G.

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IF CRANE IS IN ADJACENT BAY, MAX PICK IS 15' IF TRYING TO PICK FROM 1 SIDE.

SO, TO REDUCE LOAD, MUST PICK FROM 2 SIDES, MAX DIST. = 12.5'

$R_L = 16.6^K$

$w_2 = 4.74$ KLF

$R_L = R_R = \frac{1}{2}(16.6) + \frac{1}{2}(9)(1.16) = 13.52^K$

$M_{max} = 13.52(4.5) - \frac{1}{2}(4.5)^2(1.16) + \frac{1}{2}(1.75)^2(4.74) = 41.8$ K·FT > 38.1 K·FT

MARGINAL

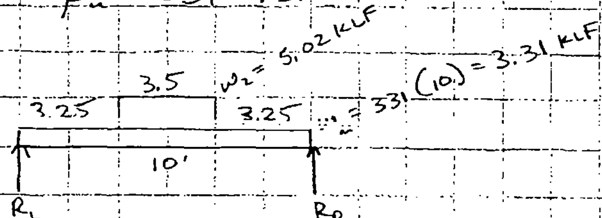
HOWEVER, PREVIOUSLY TOP STL NOT INCLUDED.

SO, O.K. BY INSP.

CHECK BEAM STRIP

WORST CASE → CRANE OUTRIGGER OVER CTR OF STRIP

$p_u = 331$ PSF



$R_L = R_R = \frac{1}{2}(5.02)(3.5) + \frac{1}{2}(3.31)(10) = 25.3^K$

$M_u = 5(25.3) - \frac{1}{2}(5)^2(3.31) - \frac{1}{2}(1.75)^2(5.02) = 77.4$ FT·KIPS

M_R (SEE PG 12) = 88.1 FT·KIPS

$\boxed{\text{BEAM STRIP O.K.}}$

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PH. 314-892-4200 • FAX 314-892-4577

BY TLB DATE 10/29/01 SUBJECT ARROWHEAD CONTRACTING SHEET NO. 15 OF 16
ST. LOUIS ARMORY JOB NO.
✓ Rw

- 1ST FLOOR, SLAB AT PERIMETER

* AT PERIMETER, SLAB IS TIED TO FOUNDATION WALL → NO PERIMETER STEEL BEAM TO CONSIDER LATERAL LOAD ON

CHECK CAPACITY OF REMAINING SLABS TO TRANSFER WIND LOAD TO SHEAR WALLS

CONSERVATIVELY USE TOTAL WINDWARD + LEEWARD LOAD = 25 PSF

F_H = 25 PSF AVG

EACH FLOOR $H \approx 16'$

PER FLOOR SLAB ⇒ $F_H = 25(16) = 400$ PLF

TOTAL WIND LOAD FOR BUILDING PER SLAB (LONG SIDE) = (400)(20)(42)
$= 336^K$

AMOUNT OF SLAB REQUIRED TO RESIST: $V_c = 2\sqrt{f'_c}\, b_w d$

$$b_w = \frac{V_c}{2\sqrt{f'_c}\, d} = \frac{336{,}000}{2\sqrt{3000}\; 5} = 613 \text{ in}$$

USE 5" SLAB AS WORST CASE

$$\frac{613}{12} = 51.1 \text{ FT} \approx 2\tfrac{1}{2} \text{ BAYS}$$

* SO, THERE IS ADEQUATE SLAB REMAINING TO RESIST WIND SHEAR

* ON COLUMN LINE L, 1ST FLOOR, IN AREAS OF REMOVAL, THE STEEL BEAMS PERPENDICULAR TO THE FOUNDATION WALL SHALL REMAIN TO CARRY LAT. LOAD &, ALSO 2ND FLOOR SLAB IS ADEQUATE TO CARRY MAJORITY OF WIND LOAD TO OUTSIDE WALLS IN THESE AREAS.

WIDEMAN & ASSOCIATES, INC.
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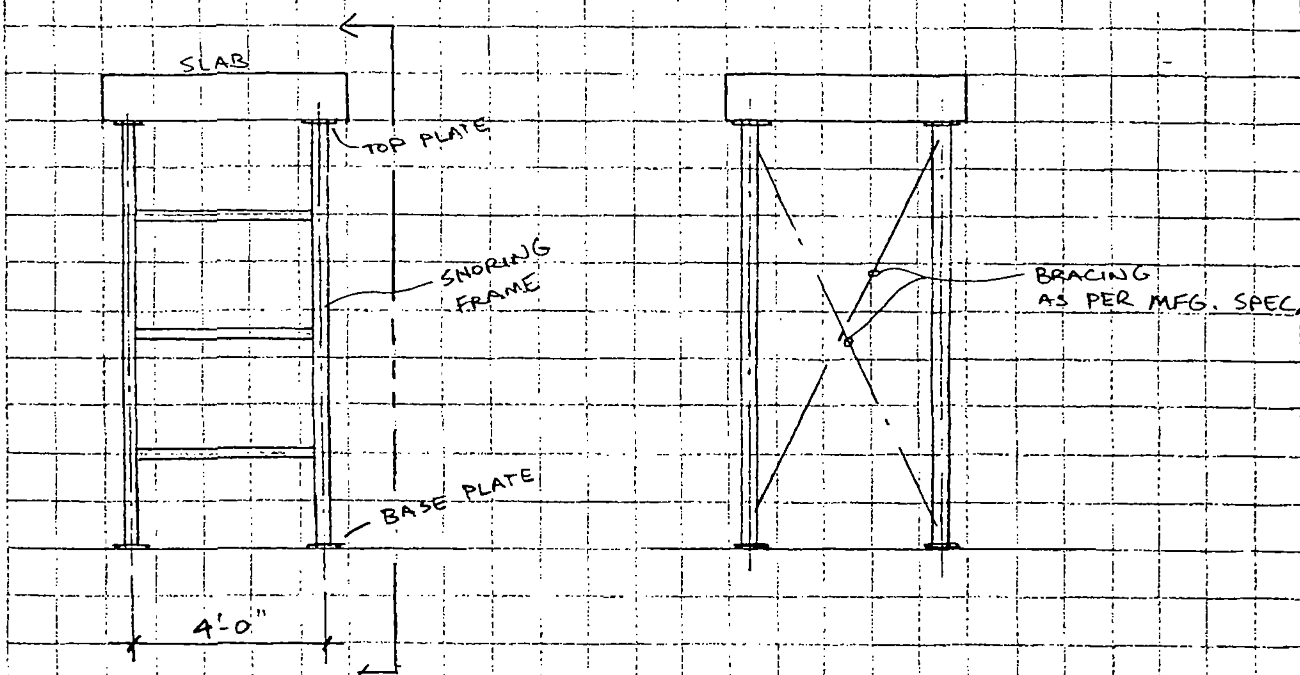
SHORING @ 1ST FLOOR THICK SLAB AREA

SLAB PIECE WT = 5,000#

USE 4' WIDE SHORING, 2 FRAMES (4 LEGS)
EA. LEG CAPACITY = 10,000#



REPLACEMENT FORM - APPENDIX E OF RA WORK PLAN

Arrowhead Contracting, Inc.

Sheet ____ of ____

DFW Inspection Checklist

Definable Feature of Work (DFW):	**Date:**	Contract No:
	Time:	DACW41-00-D0019
InspectionType (circle one): **Initial** **Follow-Up**		Task Order No. 0002

Task	Yes	No	NA	Remarks
Is the work being performed in accordance with the RAWP?				
Is the work being performed cautiously and with acceptable levels of workmanship?				
Is equipment being operated properly?				
Is the work being performed using proper methods and procedures?				
Have any defective or damaged materials been identified?				
Are results of applicable tests within acceptable levels?				
Is the work being performed in accordance with the SHERP?				
Have pertinent records been completed or collected?				
Have any nonconformances been identified, corrected, and re-inspected?				

Notes: